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Cooker Maintenance

TOO few definite facts are available regarding the cost of maintaining domestic electrical apparatus to-day. There can be no doubt as to the importance of reliable data, both as a means of forecasting expenditure and also of correcting the pessimistic cast of mind of some engineers whose experience of maintenance in early days was not too happy.

On this account the report on repairs to apparatus on hire that Lt.-Col. H. W. Watts has prepared, together with his frank criticism of several points of detail, should be valuable both to the supply and manufacturing sections of our industry.

The hiring scheme at Epsom came into operation in 1927, thus approximately coinciding with the advent of the modern cooker. Maintenance figures before that date are useless for practical purposes, and even those given in the report should be regarded as conservative, since with cookers produced during the last three years the liability to trouble has been enormously reduced. Most improvements bring their own minor drawbacks; thus there is the tendency for grease to creep into the sockets of plug-in elements, but this apparently has been obviated in a recent introduction.

A very vexed question just now is how to meet the desire of consumers to hire the very latest models of cookers. There are two aspects to this: the utilitarian and the decorative. It is relatively easy to meet the first, as modern cookers can be brought up to date in essential features at a quite reasonable cost.

A point arises here that has a particular bearing on the smaller undertaking—and it is the ability of the smaller undertaking to meet the needs of its consumers in all respects that is of outstanding moment at the present time. Has it the resources to do this remodelling and heavier repair work? Ought not the manufacturers to be able to do it more cheaply?

The undertaking would then be more free to give any emergency service that may be requisite to keep the consumer's appliances going. The manufacturer can also help the undertaking by standardising as few models as possible, thus reducing the number of spare parts to be kept at the repair depôt.

Regarding improvements in appearance, Col. Watts has got over this difficulty by confining the range to black-finished models. As every fourth consumer in Epsom cooks electrically and almost all the original cookers are still in service it would appear that this method has proved successful. There are those who advocate hire-purchase only, which has apparently proved satisfactory in America, but simple hire is essential in this country if the present rate of progress is to be maintained in competition with a live gas industry. Hire might be limited to black-finished and hire-purchase to the enamelled models.

The two chief lessons to be learned from the Epsom returns are the very modest cost of repairs of domestic electrical appliances as a whole and the big increase in energy sold per consumer that follows the introduction of a reasonable secondary charge in a two-part tariff.

The Silvertown Reorganisation

THE statement made by the new chairman of the Silvertown Company, Mr. B. H. Binder, was not lacking in candour. He accepted the invitation to join the board and become its chairman last October when a programme was already in hand for the inauguration of progressive methods, combined with economy, the object of which was to restore the business to a profit-earning basis. While the company had a good name and its products an excellent reputation, it had not adopted modern methods as early as it should have done. Although it may be perfectly true that a good name is more to be desired than great riches, a company cannot, as Mr. Binder suggested, make profits by living on its past reputation, however excellent it may have been. The work of modernisation is making headway, and the accounts submitted therefore relate to a period of transition when general depression and severe competition prevailed. Reorgan-

isation proposals, forecast a year ago, will be submitted later when the general outlook is more certain and profit-earning possibilities are nearer. The idea of closing down the Persian factory does not commend itself to the chairman after investigations on the spot; both there and at Silvertown, though in a less degree at the latter works, he found that the difficulties and losses had been accentuated by the factory being unable to produce quickly enough to meet possible sales. Reorganisation has already brought about increased production at lower cost at Persan. Times have changed very much since the company's shareholders rejoiced at half-yearly meetings in orders for the manufacture and laying or repair of submarine cables and other electrical business which earned good dividends. To-day a very large proportion of its operations is concerned with general rubber products and golf balls. A remark which may possess significance was to the effect that while demand is restricted and productive capacity is greater than ever, "individual competition should be limited by co-operation."

The C.E.B. and the Railways

THE crux of the main-line electrification question is the financial position of the railway companies, and the contribution made by Mr. J. M. Kennedy towards a solution of the difficulty, in his address to the N.A.S.E., was opportune. His suggestion that the Central Electricity Board should relieve the companies of all obligations with regard to the provision and operation of transmission lines, sub-stations, and track equipment follows the recognised principle of relieving the consumer of as much responsibility as is practicable. The Board's assistance in this way would compensate to some extent for the falling-off in employment due to the completion of contracts for the grid; it would also provide a welcome addition to the load required for the national scheme to offset the drop in the rate of increase of the industrial power consumption.

Dual Wiring

SEVERAL consumers in Wimbledon have been fined for connecting lamps to power circuits. The root of the trouble lies in the existence of two distinct prices for electricity, and the lower charge for power and heating often appears to the uninstructed public to be merely an arbitrary method of profiteering at the expense of the lighting consumer. Thus it is possible that culprits do not realise fully the moral aspects of such practices. One of the advantages of a good two-part tariff is that it places no strain on the honesty of the consumer and does not tempt him to concern himself with factors in tariff making that are beyond his knowledge. Undertakings that charge a very low lighting rate would find it very difficult to introduce a two-part tariff including a fixed charge, but the difficulties arising out of differentiation between two classes of supply might be avoided by a block tariff in which a definite number of kWh (depending on the size of the house) was charged for at a certain rate and all in excess at a lower rate, whatever the purpose for which the energy is used.

Amateur Operation

IN a monthly magazine a comparison is drawn between public and private supply for country houses. An example is worked out on a tariff of £14 per kW connected and 1½d. per kWh for a connected load of 6 kW, including 150 lights, vacuum cleaners, irons, &c., but not including any heating or cooking; the consumption is given as 2,500 kWh per annum at an average cost of 9d. The cost of oil-engine plant is estimated at 6.5d. per kWh, including maintenance at 5 per cent. for the battery and 1 per cent. for the rest of the plant; no allowance is made for attendance. Our own experience is that country-house owners welcome a public supply. The reason for this is that under the care of the gardener or chauffeur the plant and batteries deteriorate, largely due to a lack of skill in detecting minor defects, which are left until a serious breakdown occurs. Within a few years the plant becomes a source of anxiety to its owner, who looks to the public supply to relieve him of all responsibility in the matter.

Six Years' Progress

THE *Board of Trade Journal* for December provides statistics relating to electricity supply for the year 1930 and compares the position with that prevailing in 1924 when the last returns were made. Most of the data have been made available previously in the reports and returns of the Electricity Commissioners. One point brought out is the increase in the work done by undertakings' employés on consumers' premises. The value of this was £2,172,000, an increase of more than 120 per cent. over the 1924 figures. Public lighting progress is reflected in an increase of 65 per cent. in the cost of work (£553,000) for this service. Work carried out by employés connected with the generation of electricity was only 4 per cent. more than at the last Census of Production, but that on distribution increased by 78 per cent. These figures form a good indication of tendencies in electricity supply.

Voltage Variations

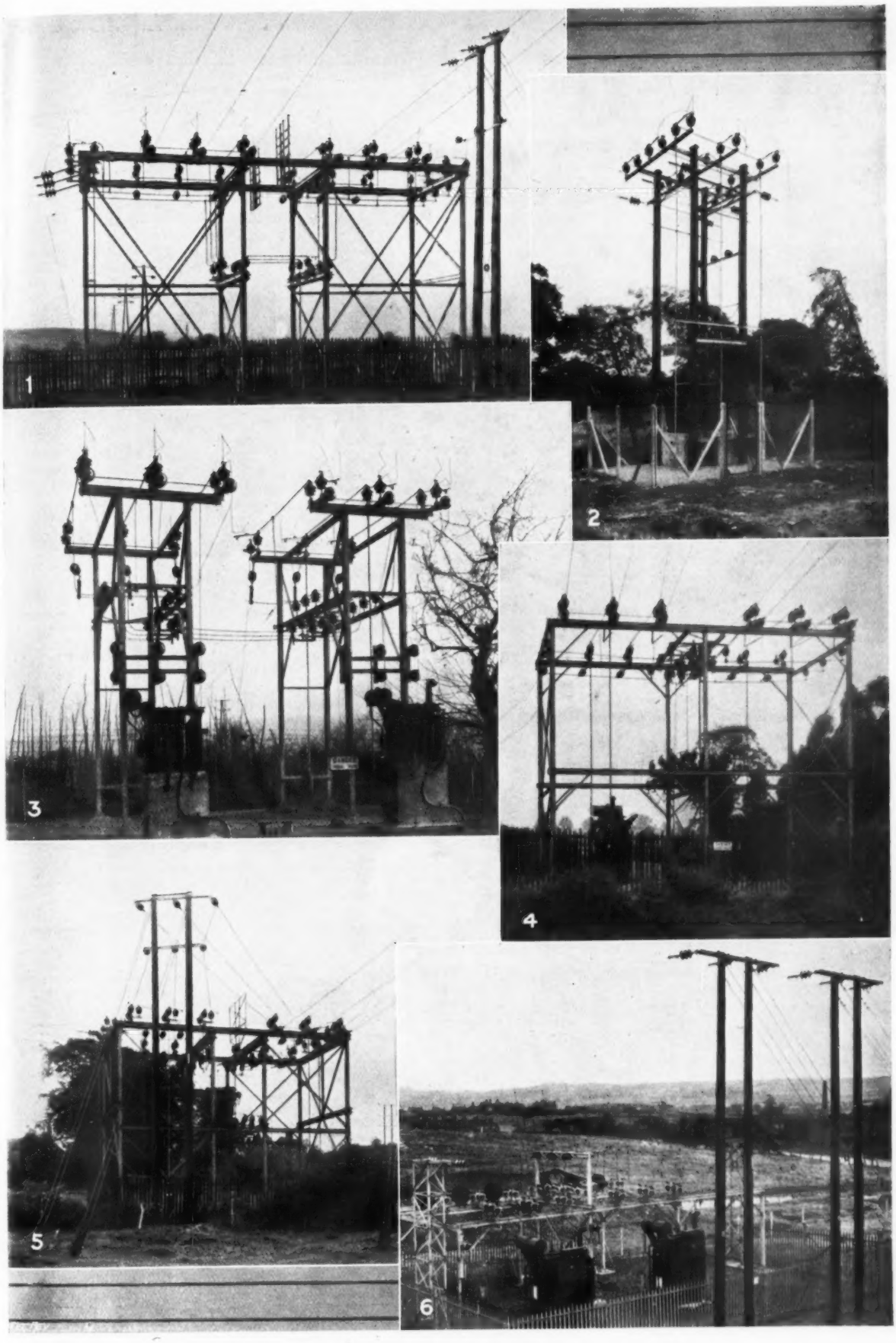
A LAY contemporary has turned its attention from electricity tariffs to the effect of voltage variations. In the past we have expressed a doubt as to whether there would be any justification for extending the range of *plus* or *minus* four per cent. permitted by the existing regulations, but the writer of the article evidently considers that far too much latitude is already allowed. In an article entitled "All-electric House Worries," it is stated that an increase of four per cent. in voltage halves the life of all domestic apparatus, while a similar decrease reduces efficiency by twelve per cent. What have our electrical manufacturers to say to published statements of that kind? We know of many distribution systems in which full advantage is taken of the margin allowed, but the effects, even on the lamps, are not so disastrous.

"You're Another!"

WE hope that "the rising generation" of electricity supply employés will not suppress their views because one of their superiors, "M.I.E.E.," sees fit to castigate, on a later page, a correspondent who a fortnight ago dared to offer criticism. The ELECTRICAL REVIEW is everybody's platform, and both "crabbed age and youth" are welcome to make use of it. The shortcomings of some electricity supply engineers will inevitably come under discussion as we try to clear obstructions from the path of free and full electrical distribution development. We may expect hard words to be used. While it is perfectly true that these break no bones and that they cannot alter facts, the discussion of who is to blame will be more profitably conducted if each side tries to understand the other man's point of view. We welcome the enthusiasm of the young man who wants to get on, and we value the experience of those who, having got on, are perhaps within a few years of getting out. But cannot we pool our resources of youth and experience without throwing stones? The business will make its greatest headway if we are all young in heart. Some chiefs may be more considerate in their treatment of committeemen who do not know than of their assistants who do!

Current Accounts

IT is reported that an American scientist has suggested that the kilowatt-hour of electricity should be used instead of gold as the American standard of value of all monetary transactions, public and private. He says that by this means absolute stability would be secured, and he proposes an "Edison dollar" defined as forty kWh. But would not this new currency (as it seems quite proper to call it) sometimes be subject to the ill-effects of low power factor?



Examples of Rural Sub-station Construction (*see page* 961)

1. A switching station arranged for separation into two parts for maintenance purposes. 2. A sub-station which is shut down for maintenance work at week-ends. 3. A terminal station fed by a six-wire line. 4. A sub-station sectionalising a duplicate feeder. 5. A more elaborate arrangement. 6. Outdoor equipment for duplicate feeders (six-wire line)

D

Feed-water Heating. By R. Livingstone, A.M.I.E.E., A.M.I.Mech.E.

The infuence of flue-gas losses—the overall economy of bled steam

THE economy of bled-steam feed-water heating is generally considered from the point of view of the steam cycle and on the assumption that the boiler-house efficiency remains constant.

In new installations the estimated gain in heat consumption in the engine room can be realised in the boiler house by an increase in economiser or air-heater surface. Such an increase adds to the capital charges and reduces the commercial gain due to feed heating. As a result the degree of feed heating to give the minimum cost per unit is less than the degree which gives the minimum heat consumption.

Where an air heater is installed in addition to an economiser, an increase in feed-water temperature may permit a small reduction in the boiler or economiser surface and entail a larger increase in the air heater. For each temperature of feed water there is an economical exit-gas temperature, which can be found by tabulating the coal costs and capital charges for varying heating surface.

In the engine room an increase in bled-steam heating permits a reduction in condenser surface of nearly the same amount as the increase in heater surface, but the cost per sq. ft. of heater surface is higher than the cost per sq. ft. of condenser surface.

Most Economical Feed Temperature

The most economical feed temperature can then be found by tabulating the increase in engine-room capital charges and reduction in coal bill due to the steam cycle together with the increase in boiler-house capital charges and increase in coal bill due to increased flue-gas losses for various feed temperatures. The determination of that temperature is not difficult, but it involves the analysis of the effect of many variables on the fuel cost and capital charges.

Owing to the concentration of attention on power-station efficiency in recent years equal weight is not always given to economy of capital and to economy of fuel, but in general recent power-station designs are utilising bled steam for intensive feed heating to an increasing extent. In one example where this question has been given careful study the feed-water temperature is raised to within 200 deg. F. of the saturated steam temperature by bled steam and a further 100 deg. F. in the economiser.

As the flue gases are reduced to a final temperature of 230 deg. F. it would appear that at present costs of heating surface the economical feed temperature is close to the limits imposed by permissible maximum furnace and minimum exit-gas temperatures.

In considering the application of feed heating to existing power plants, the boilers may not be fitted with air heaters, and it may be impracticable to increase the surface of the economiser. In such cases it is sometimes assumed that the exits flue-gas temperature is increased by the same amount as is the feed-water temperature. If this were true the percentage loss in the flue gases for an increase of t deg. F. in feed temperature would be $0.36t/CO^2$ or with an average value of 12 per cent. CO_2 by $0.03t$ per cent.

In an actual case where the feed-water temperature in a power station was increased from 130 deg. F. to 190 deg. F. with a lower exit-gas temperature at normal evaporation of 420 deg. F., the increase in flue-gas temperature was about 35 to 45 deg. F.

Exact figures are difficult to obtain on an actual test on account of the changes in gas temperature due to soot blowing and variations in CO_2 which make snap figures unreliable within 10 deg. F. The formation of scale and other fixed impurities on the heating surfaces and consequent gradual increase in the average outlet-gas temperature renders extended tests for average figures of uncertain value.

By making certain arbitrary but not unreasonable assumptions the change in gas temperature for any conditions can be estimated. The heat from the coal is transferred to the steam mainly by radiation and convection. The radiant-heat transfer is important, as it varies in accordance with the Stefan-Boltzmann Law, whereas the heat transferred by convection is proportional to the temperature difference and rate of conductivity of the gas film and materials between the gas and water.

As combustion temperatures are not in question it can be assumed that for contraflow gas and water the drop in temperature difference is logarithmic and that the initial temperature difference is the ideal furnace temperature—without allowing for the drop due to radiant heat—less the saturated steam temperature.

For ordinary cases with average values of CO_2 and steam pressures, the initial temperature difference can be taken at 3,000 deg. F. This figure need not be very exact as a moderate variation does not seriously affect the results.

Rate of Heat Transmission

The change in exit-gas temperature depends on the change in the total heat transmitted and on the variation in the rate of heat transmission. The rate of heat transmission varies with the velocity of the flue gases. For fire-tube boilers Nusselt found that the rate of heat transmission varied as $C(V)^{0.786}$ when V is the gas velocity, *i.e.*, 1 per cent. increase in velocity gave 0.786 per cent. increase in the rate of heat transmission.

The variation in the rate of heat transmission in three water-tube boilers and economisers of the same size and in the same condition, as estimated from a mean temperature difference, is shown in fig. 1.

Increase in the exit flue-gas velocity is proportional to the absolute temperature of the gases and the average increase can be taken at half this value. On the above assumptions it can be shown that the percentage reduction in boiler efficiency for an increase in feed temperature of t deg. F. accompanied by a saving in the steam cycle of h per cent. $= \left\{\frac{t}{a} - \frac{h}{b}\right\}\%$ (1)

The values of a and b are shown in fig. 2 for 12 per cent. CO_2, and in the table on the opposite page the detail figures are given for a normal exit-gas temperature of 500 deg. F.

In fig. 2 τ is the total exit temperature and τ_2 the exit temperature less feed temperature.

In the test already referred to τ=420 deg. F. and τ_2=290 deg. F. From fig. 2 the value of a=48.5 and the value of b=22.5. As the tests were based on equal total heat transmission the value of h in equation (1) is zero and the loss in

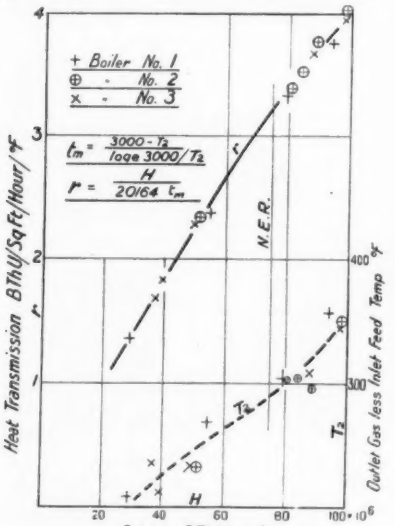

+ Boiler No. 1
⊕ - No. 2
× - No. 3
$t_m = \frac{3000 - T_2}{\log_e 3000/T_2}$
$F = \frac{H}{20164\ t_m}$
N.E.R.
Heat Transmission BThU/Sq Ft/Hour/°F
Outlet Gas less Inlet Feed Temp °F
Output - BThU per Hour

Fig. 1

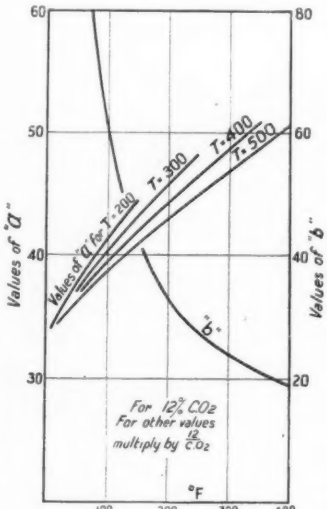


Fig. 2

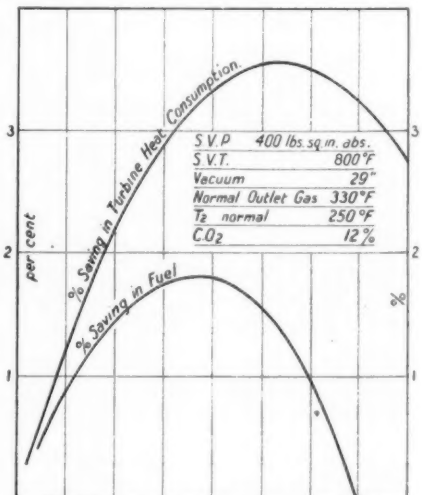


Fig. 3

Some Driving Forces in the Industry: The General Electric Co., Ltd.

1. Mr. M. J. Railing (*Elliott & Fry*), joint managing director. 2. Sir Hugo Hirst, Bt. (*Elliott & Fry*), chairman and managing director. 3. Dr. A. H. Railing (*Elliott & Fry*), director in charge of the Witton group of works. 4. Sir William Noble (*Claude Harris*), director in charge of the Telephone Works, Coventry. 5. Mr. J. Y. Fletcher (*Int. Rotogravure*), director in charge of the lamp and valve sales organisation. 6. Mr. C. Wilson (*Elliott & Fry*), director in charge of lamp and valve works. 7. Mr. L. C. Gamage (*Int. Rotogravure*), secretary and export director. 8. Mr. F. Winstanley (*Haines*), director in charge of lighting fittings and household appliance sales. 9. Mr. S. D. White (*Haines*), director in charge of wireless sales and Government and railways department. 10. Mr. H. W. Roberts, director and sales manager. 11. Mr. M. Solomon (*Speaight*), director in charge of wires and cables. 12. Mr. G. H. Ide, director in charge of Magnet Works, Birmingham. These twelve directors, holding active executive positions, have a total of 403 years' service—an average of thirty-three years

Feed-water Heating—(*continued from opposite page*). the flue gases is $t/48.5$ instead of $t/33.3$ if the flue gas increased in temperature as much as the feed temperature. The estimated increase in flue-gas temperature is 69 per cent. of the increase in feed temperature, whereas the observed increase was 58 per cent. to 75 per cent. The flue-gas losses minimise the gain in heat consumption estimated for the steam cycle.

Fig. 3 shows the gain in heat consumption of a turbine with single-stage feed heating from a point in the expansion where the saturated-steam temperature is 10 deg. F. higher than the final-feed temperature, and for comparison the corresponding gain in coal consumption with a normal boiler is shown on the same figure. So far as the steam cycle is concerned the greatest saving is 3.5 per cent. for 103 deg. F. feed heating, but when the effect on coal consumption is considered the greatest saving is only 1.8 per cent. with feed heating at 75 deg. F.

For final-feed temperatures under about 200 deg. F. an increase is beneficial in reducing the amount of scale formed on the economiser tubes and in cases where other sources of feed heating are not sufficient to give this inlet temperature, bled-steam heating can be used to a greater extent than is justified by the coal saving alone on account of the lengthening of the time that the boilers can be kept in commission.

The capital charges offset the coal saving by a small amount, but do not alter the feed temperature for maximum gain to any extent as the bulk of the expenditure is a constant and only a portion varies with the surface required for the heater.

VARIATION IN FLUE-GAS EXIT TEMPERATURE WITH INLET FEED TEMPERATURE.

(1) Exit-gas temp., less inlet-feed temp. °F. ...	T_2	100	150	200	250	300	350	400
(2) $\frac{3{,}000 - T_2}{\log_e 3{,}000/T_2}$	t_m	853	951	1,034	1,107	1,173	1,232	1,290
(3) Per cent. variation in T_2 for 1 per cent. variation in: mean temperature tm, total heat transmitted, or rate of heat transmission	%	3.7	3.5	3.34	3.22	3.1	3.0	2.9
(4) Per cent. variation in mean gas velocity for 1°F. increase in exit-gas temperature ...	%	0.052	0.052	0.052	0.052	0.052	0.052	0.052
(5) °F. variation in T_2 for 1° F. increase in exit-gas temp. $0.85 \times (4) \times \frac{T_2}{100} \times (3)$ ...	°F.	0.164	0.232	0.296	0.356	0.421	0.465	0.513
(6) Increase in exit-gas temp. per °F. increase in feed temp. $1/1+(5)$	°F.	0.86	0.812	0.775	0.738	0.704	0.683	0.662
(7) Value of a in equation (1) $33.3/(6)$	a	38.8	41.0	43.0	45.0	47.2	48.8	50.2
(8) Value of b in equation (1) $3330/0.15 \times (3) \times T_2$	b	60.0	42.2	33.2	27.6	23.9	21.1	19.1

Keeping Domestic Appliances in Service

A COMPREHENSIVE report on the cost of repairs to apparatus on hire by Epsom U.D.C. has been prepared by Lt.-Col. H. W. Watts, the electrical engineer to the Council. From this we have taken some interesting information likely to be of interest and assistance to other electricity supply engineers and managers.

At September 30th there were 846 cookers on hire, but the figures relate only to the 608 that have been in use for over twelve months in the homes of 334 ordinary consumers, and 132 and 142 consumers in the Horton and Hookfield housing estates, respectively. The revenue received for all purposes, including rentals, was £7,598 for 1,344,000 kWh (2,211 per consumer), averaging 1.36d. per kWh and £12 9s. 11d. per consumer. The cost of repairs worked out at 0.115d. per kWh, or £1 1s. 2d. per consumer.

Costs of Upkeep

The total connected load is 5,046 kW; in addition to the 608 cookers, this figure covers the same number of kettles, 488 irons, 337 fires, 174 washboilers, and 44 water heaters. Col. Watts divides his consumers into three groups for the purpose of his analysis: (1) "private"; (2) Horton housing estate; and (3) Hookfield housing estate.

The cookers are "Magnet," "Jackson," "Cosmos," "Creda," "Tricity," "McClary," and "British Standard" in twenty-seven models. Maintenance costs per annum for the different makes in the first group vary from 6s. 11d. to £1 5s. 5d. (including remodelling), giving an average of 11s. The 3 to 6-pint kettles cost in repairs 5s. 2d., the irons 1s. 4d. (75 per cent. due to flex), fires 1s., wash-boilers 1s. 1d., and water heaters 2s. 6d.; the costs in the last three items were all due to element failures. The overall average cost of repairs was 17s. 6d. per consumer. This sum includes special items of expense, but does not cover free replacements of hot-plates.

[*Elliott and Fry*

Lt.-Col. H. W. Watts, electrical engineer to the Epsom U.D.C.

On the "all-electric" Horton estate with its 132 consumers the cost of maintaining the 1.480 kW of hired apparatus was £1 9s. 2d. per consumer. Three years ago the equivalent figure was only 12s. 2d.; the increase is attributed to fair wear and tear, as all the apparatus has been in operation for five years.

The houses erected on the Hookfield estate were originally wired for lighting only, but by October, 1931, 142 of the 180 tenants had electric cookers, kettles, and irons installed, and some had also wash-boilers, water heaters, and fires; no gas is available. The total repairs averaged £1 2s. 4d. per annum, cooker maintenance cost from 9s. 7d. to £1 4s. 8d. each, varying with the make of cooker.

The annual hire charges for cooker installations are based on 10 per cent. of the cost, including that of the control board, 30 ft. of wiring, and of the kettle which is sent out with all cookers. For all other apparatus the annual charge is 10 per cent. of the cost. Capital cost is not considered so important as good design and robust construction. All cookers are inspected periodically and brought up to date when necessary.

Since the introduction of the apparatus-hiring scheme in 1927 there have been great improvements in the design, finish and construction of electric cookers. The difficulty of reconciling the wish of consumers to have the most modern cookers with the necessity of keeping the original cookers out on hire has been met by not installing those with a "de luxe" finish and remodelling older types. Of the 866 cookers purchased, 846 are still in use, whereas it is believed that quite 300 would have been returned had this policy not been adopted. The consumer is usually satisfied by the addition of hot-cupboard door fittings and enamelled hob. During the past twelve months thirty-four cookers have been exchanged for larger sizes.

The Hot-plate Question

The enclosed type of hot-plate is regarded as better than the open, although the maintenance cost of the latter is low and a fault can often be rectified on the consumer's premises; several have been in use since 1927 without a failure. There is still room for improvement in the life of the enclosed hot-plate; it is considered that the latter should have a loading of not less than 1,000 W and be arranged for three heats. When of the round type the diameter should be at least 6¼ in. It is regarded as a matter of fashion whether the round or rectangular design is preferred.

For the oven and grill the open-type element is considered the most suitable. In only one make of oven used at Epsom does the temperature reach 400 deg. F. in twenty minutes. The performance of the grill is generally very satisfactory. Some of the kettles, which are all of the Bulpitt make, are installed with a combined saucepan for egg-boiling, &c.; the original type of element with the replaceable safety capsule receives high commendation. The elements of the water-heaters now installed are satisfactory, and failures are not anticipated in the future. Washboilers should be selected with especial regard to the method of fixing the elements.

The beneficial effect of a reduction in the secondary rate of a two-part tariff is shown by the fact that the average annual consumption on the housing estates was doubled, when the 1¼d. rate was lowered to ¾d. per kWh.

Radio Research

IN the course of its report for 1931 the Radio Research Board refers to tests made on Bredon Hill, near Evesham, to investigate the possibility of the presence of downcoming radiation on 5.5 metres. Signals were received from Rugby at a distance of forty-four miles and it was observed that there was a distinct diurnal variation of signal strength. On a hot day the strength gradually diminished towards noon and attained the minimum at about 1,400 G.m.t., and thereafter gradually improved till early morning strength was regained towards 1,800 G.m.t. This effect has already been observed by Jouaust on the 5-metre signals of the France-Corsica service, and has been attributed to variable refraction in the lower atmosphere (mirage). Further tests made by the Board on dull autumn days support this theory. A number of experiments are also recorded on a wavelength of 1.6 metres.

The report indicates that considerable progress has been made towards the development of the "perfect" direction-finder for medium waves, free from errors caused by downcoming waves occurring mostly at night. The report also shows that accurate direction-finding should soon be possible on short waves. Hitherto this has been deemed impracticable, but the difficulties are now evidently being rapidly overcome.

Progress is also recorded in the study of improved means for generating oscillations of a few centimetres wavelength. There is an upper limit in frequency (about 300 million cycles per second) of the oscillations obtainable by means of the ordinary retroaction type of valve transmitter. This limit is set by the time of transit of the electrons between the grid and anode becoming comparable with the period of the oscillations, so that the necessary phase relation between the current in the valve (*i.e.*, the motion of the electrons) and the voltage of the electrodes is impossible.

It has been found that certain valves can be made to oscillate at very high frequencies (up to about 10,000 million cycles per second) if the grid has a high positive and the anode a slightly negative potential with respect to the filament. The individual electrons in the valve are given a to and fro motion about the grid, which under favourable conditions may give rise to oscillations. Waves only a few centimetres long have been produced from existing valves, and the results obtained are being employed in the design of valves more suitable for the generation of energy on waves of these frequencies.

The primary national standard of frequency is maintained at the National Physical Laboratory and the tuning-fork rate can be obtained accurately to within one part in ten million. Experiments are in progress to determine the short-period constancy of the fork, *i.e.*, for one or two minutes at a time, and sufficient experience has now been accumulated to enable the statement to be made that properly designed and steadily operated tuning forks form a primary frequency standard of reliability of about one part in ten millions, a result fully equal to that of the best pendulum clocks.

Accurate Measurement

It has become necessary to develop apparatus to resolve the differences between a tuning fork and a clock to enable short period fluctuations to be accurately observed. For this purpose radial vibrations of a small quartz crystal very carefully cut in the form of a ring are used to control the oscillation of a valve generator, and experiments give good hope that a standard which is permanent and accurate to one part in a hundred millions may be obtained.

The Physical Society's Exhibition

A comprehensive display of scientific apparatus

THE twenty-third annual exhibition of physical and optical apparatus arranged by the Physical Society of London is to be held as usual at the Imperial College of Science and Technology, South Kensington. A discourse will be delivered on each of the three show days (January 3rd to 5th) and illustrated by experiments. Dr. Allan Ferguson will deal with surface tension and its measurement. Mr. R. A. Watson Watt's subject will be cathode-ray oscillography, and Mr. F. Hope-Jones will describe time measurement, old and new. The display of exhibits will be sectionalised. To the research section contributions are being made by most of the important British laboratories, and a sub-section is to be devoted to experiments of educational interest. Work submitted by apprentices and learners for the craftsmanship competition will be on view, and the latest products of the leading instrument manufacturers will be displayed in the trade section.

AN interesting device has been evolved by the Electrical Research Association and the G.E.C. research laboratories for the purpose of determining the movement of air around lamp fittings and kindred hot points. As a result of two years' investigation by a committee of the Association under the chairmanship of Mr. C. C. Paterson, the behaviour of these air currents is found to have a considerable influence upon the heating of lamp fittings and their connecting leads.

Conclusions now reached, and demonstrated by the apparatus which will be on view, will go a long way towards minimising the difficulties which manufacturers, cable makers, and electrical contractors have experienced in regulating the heating of lighting fittings. The apparatus may also be employed for rendering visible the products of combustion, or the passing of gases which are heavier than air, and a model will demonstrate the advantage of placing a radiator beneath an open window rather than in the orthodox position.

Bellingham & Stanley, Ltd.

The Hallimond magnetic separator is designed for the examination of powdered minerals and sands by passing them below three magnets of different strengths, the machine being motor driven and fed by a hopper.

The automatic photo-electric photometer invented by Dr. R. Guelke splits light issuing from a slit into two beams by a rotating mirror disc. One beam traverses, or is reflected from, the sample and falls upon the photo-cell alternately with the other beam, which follows a

A new teleprinter

symmetrical path. The alternating potential thus set up, after valve amplification, is fed to a rectifying commutator on the motor shaft, and then to a moving-coil instrument. The moving element of the latter carries a wedge-shaped aperture in the path of one of the light beams, which cuts down the light in one beam until equality is secured, the reading of the moving-coil pointer being then noted.

British Electric Resistance Co., Ltd.

The new teleprinter illustrated by the courtesy of Painton & Paul, Ltd. (patentees) is a comparatively inexpensive machine with a normal typewriter keyboard. No signal is transmitted until a key has been depressed and the operator's finger taken off the key, when this key, in common with the other keys, is locked until the signal is completed. The machine is capable of being readily adjusted for speed in order to cater for varying degrees of operating skill.

Receiving is effected by means of an inked displacement record on standard Morse tape, and the machine is equally suitable for operating over wired or radio circuits. It is power driven by a small electric motor or by a slave clock when electricity is not available. The overall dimensions of the machine are 8¾ in. wide by 7½ in. deep by 6 in. in height.

The new "Berco" back-of-board rectifier and battery-charging resistance consists of two vitreous enamelled steel formers, mounted vertically to allow for ample ventilation, the mounting bracket acting as a screen between the formers and the panel. Regulation is obtained by direct driven brush-gear on an operating shaft.

High-voltage wire-wound resistances for use with X-ray and electro-medical apparatus, for voltages up to 100,000, are made up to 500,000 ohms.

Cambridge Instrument Co., Ltd.

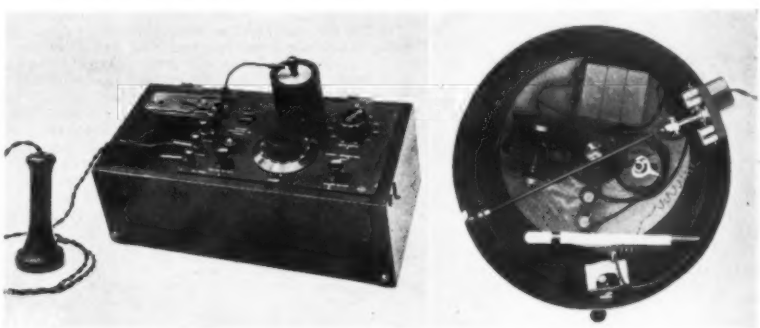
This exhibit will appeal particularly to research laboratories and teaching institutions. Galvanometers for a.c. and d.c. measurements include a d'Arsonval moving-coil, moving-magnet, and string types. Four different types of string electrometers will also be shown. A new robust and inexpensive galvanometer for general "bridge" work is the "Pot," which has a sensitivity as a reflecting instrument of about 12 mm. per micro-ampere at one metre, its resistance being 50 ohms, and its period 1.3 seconds; as a pointer instrument its sensitivity is of the order of 35-0-35 micro-amperes for 7-0-7 divisions.

Among the a.c. instruments will be the Campbell precision condenser bridge and soil conductivity bridge (illus.). The latter gives a direct reading of the specific resistivity of a sample and its specific resistance is found by taking the reciprocal of this value. It has a range from 1 to 1 by 10^{-5} mho/cm³. The design of cell ensures that at all times its constants can be checked and thus avoids the troublesome experiments necessary with dipping or other forms of electrode.

A special section is being devoted to hydrogen-ion measurements and the new hydrogen-ion meter (electrometer valve pattern) is being exhibited along with the Morton glass electrode system. In addition, outfits for both research and industrial purposes will be shown, together with a complete recording outfit.

Among engineering instruments a new illuminated moving scale indicator may be calibrated for temperature, percentage CO_2, &c., and is fitted with green and red screens with an intermediate clear section to indicate safe limits of working. There will also be a new precision draught gauge and accelerometers of the statistical and rotational patterns.

A new recorder employs the properties of the photo-electric cell for recording smoke and other suspensions of solid particles in air, gases, or liquids. By using a diffraction as against a transmission method, zero errors are avoided and the effect of dirty optical work minimised. A moisture meter depends for its operation on the high dielectric constant of water. The material under test is used as a dielectric in a test condenser, the capacitance of which varies with the moisture content of the material. The meter can be used to determine the moisture content of tea, tobacco, clays, and other substances.



The Cambridge soil conductivity bridge and "Eupatheostat"

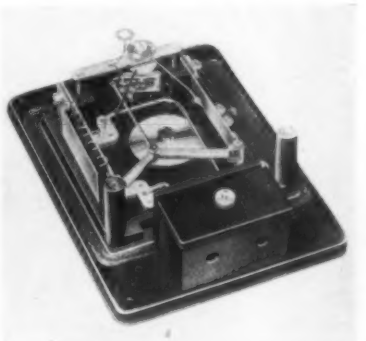
Physiological instruments will be represented by a portable cardiograph and of special interest will be the new "Eupatheoscope," or "comfort meter" (illus.), designed in collaboration with the Building Research Station for checking heating installations.

E. K. Cole, Ltd.

Radio instrument production testing equipment will be demonstrated, such as a master signal generator consisting of five independent mains-operated oscillators, each with a self-contained modulator.

Crompton Parkinson, Ltd.

New thermal maximum demand indicators (illus.) will be shown for the first time. Two strips of bi-metal fixed parallel to each other with the upper end of each rigidly secured to a moulded "Bakelite" base plate, have their lower free ends connected by lines and a connecting rod to a quadrant and pinion movement, the pinion spindle of which carries the operating pointer, whose deflection is proportional to the variation of distance between the free ends of bi-



A Crompton Parkinson maximum demand indicator

metal strips. The bi-metal strips are so arranged that one operating strip is adjacent to a heater element which carries the main current, and its temperature is thus raised above that of the compensating strip, which is remote from the heater, the distance between free ends of the strips is decreased, and the pointer is constrained to deflect over the scale. The deflection of the pointer is therefore proportional to the increase of temperature of the heater element and is unaffected by changes of ambient temperature.

The operating pointer pushes before it the maximum demand indicator pointer, which is retained by friction at the highest point to which it is forced until reset by a knob on the front of the case.

"A.C. Test" instruments are made with a principle of operation similar to that of an ordinary moving iron instrument, but instead of the movement operating within the field of a coil surrounding the moving iron it is placed in a suitably shaped gap in a pack of circular iron stampings similar to those used in a ring type current transformer. The effect, therefore, is to combine a transformer and an indicating instrument in one piece of apparatus.

Types "B," "C" and "D" "Tong-Test" instruments have been produced since the last exhibition, and have already found a considerable sale in the United States and other countries not normally purchasing from British makers. It is claimed to be the only instrument of its type which will indicate on direct current, and many of the tests possible with the a.c. test instrument are also possible with the trigger-operated, split electro-magnet "Tong-Test," which operates on the same principle.

Portable single-element dynamometer wattmeters of robust and simple construction have unusually long scales for this type of instrument, and a double current range is also available. A new range of high accuracy moving-iron "Mumetal" milliammeters, ammeters, and voltmeters having scales 3½ in. long will form another section of the exhibit.

Drayton Regulator & Instrument Co.

New developments in switches include a bi-metal coil-operated thermostat for controlling room temperature, ovens, and similar applications; a pressure-operated switch, and an immersion switch for the temperature control of liquids.

There will be a ratio volume regulator for controlling the flow of a fluid in one pipe relative to that in a second pipe, and a ring balance recorder for flow, differential pressure, pressure, or vacuum, which is driven by a synchronous motor.

A development of the previously exhibited "heat motor" electrically operated valve with automatic excess pressure cut-out is operated by the generation of vapour pressure in a bellows by means of a small electrical resistance arranged in a depression formed in the top plate of the bellows.

Type "O" valve and damper operating motor will be shown.

Dubilier Condenser Co. (1925), Ltd.

Besides mica- and paper-insulated condensers, newer products are electrolytic condensers and metallised resistances consisting of a coated glass rod assembled inside a ceramic tube for protection and to act as a radiator, metal caps being moulded on.

Radio-frequency interference suppressors for motor-car sparking plugs and coil-ignition distributors are also to be shown.

Ebonestos Insulators, Ltd.

This company manufactures mouldings to customers' specifications in synthetic resins and also in various grades of "Ebonestos," particularly for the instrument-making, electrical, and kindred industries.

Edison Swan Electric Co., Ltd.

This company's cathode-ray tubes for indicating a.c. wave forms are fitted with improved fluorescent screens, exciter units (illus.), and time base apparatus. A d.c. to a.c. invertor, using mercury-vapour valves, will show the output wave form of the cathode-ray oscillograph.

Mercury-vapour rectifiers are made up to 40 kW at d.c. output voltages up to 15,000 V; also hot-cathode gas-discharge rectifiers for battery charging, and B.T.-H. thermionic rectifiers up to 200 kW. Radio valves will be on view, as well as high-vacuum thermal relay switches, hydrogen-filled mercury switches in special quartz heat-resisting glass, and various types of barretters for current control from 6 A down to 100 mA, the latter designed for use in the cathode heater circuit of a d.c. mains receiving valve.

W. Edwards & Co.

The range of vacuum pumps made by this company now comprises over sixty different types and sizes, varying from small laboratory patterns to pumps of large capacity which are capable of fulfilling the exacting requirements of the electric lamp and radio valve manufacturing industry.

The "Hyvac" pump, having a capacity of 210 c.c. per second and giving a vacuum of 0.0004 mm., is a good example of the smaller types, while the A and B series represent the larger types, with capacities up to 7,500 c.c. per second and giving a vacuum of 0.0001 mm. direct from atmosphere. For still higher vacua diffusion pumps are added to the rotary oil pump; these have very high capacities and give vacua of 10^{-6} mm. or better.

A valve exhausting bench (illus.) will be shown, and photographs will be available of some of the latest types of automatic lamp- and valve-making machinery. A range of gauges will be exhibited, reading from a few centimetres down to extremely low pressures.

Other exhibits will include a high-frequency generator suitable for the eddy-current heating of radio valves and laboratory purposes, such as the vacuum melting of metals.

Elliott portable thermocouple potentiometer and "Multiversal" current transformer

Elliott Brothers (London), Ltd.

A power factor finder and circuit analyser (Shotter patent) measures the single-phase power factor of a circuit and operates as a very sensitive differential wattmeter. It consists of a sensitive detector, potentiometer rheostat, and a small change-over switch. The approximate range of the instrument is from unity to 0.35 lag and 0.1 lead, and its indications are correct irrespective of the way in which the leads are connected to their particular pair of terminals.

Link and fuse pattern current transformers (Shotter patent) are specially adapted for measuring the current passing through links in distribution boxes and fuses in feeder pillars, respectively, where space is very limited, and where it is not permissible to open the circuit. The standard ranges of these instruments are 100 and 400 A.

For indicating and recording the speed and other operations of rotating machinery and plant a d.c. magneto generator is driven by means of a belt or chain, or by direct coupling to the shaft of the machine or engine, and gives a voltage directly proportional to the speed.

An Ediswan exciter unit

Other exhibits will be an averaging recorder for measuring and recording the total consumption and the maximum demand averaged over a definite time interval; a portable thermo-couple potentiometer (illus.); and an automatic regulator for controlling and maintaining temperature, humidity, pressure, etc., at predetermined values or between defined limits

Everett, Edgcumbe & Co., Ltd.

This company's fault grapher has had its recording element modified to reduce its free periodic time. The deflecting torque has been increased some four times, whilst the moment of inertia has been reduced to less than half, resulting in so great a responsiveness that the pen takes less than one-tenth second to reach its reading, even from zero to the far side of the chart.

The "Metrohm" is well known as a resistance or insulation tester. The "dwarf" instrument combines both functions and will measure insulation up to 100 megohms on one scale as well as resistances up to 20 or more ohms on another.

A compact little outfit, which measures only 4 in. by 3¾ in. by 2 in., enables almost every radio measurement to be carried out with ease. It comprises a dead-beat moving-coil instrument, together with the necessary series and shunt resistances, etc. By means of an external rectifier the various ranges can be made available for a.c. testing.

Various applications of the "Synclock" (Warren) self-starting synchronous motor include street lighting time switches, which are self-supporting on plug terminals. An externally accessible press switch is provided so that the attendant can at any time test a lamp without interfering with the setting of the time switch. When fitted with a "solar" dial, the time switch can be left entirely unattended, and when more complicated sequences of switching operations are involved the "Synclock" programme clock is available.

To the electrical time interval meters two new models have been added during the year, and are shown for the first time. The standard model (illus.) has a "Synclock" (Warren) motor running continuously, and at the passage of the fault current the indicating pointer is meshed with the synchronous motor and continues to revolve until the relay contacts

close, or the circuit breaker opens, when the pointer stops and the time interval which has elapsed may be read off direct on the scale. This model is suitable for time measurements between 1-20 seconds and 10 seconds. The Model II instrument is intended for the determination of longer time intervals, say, from ½ second to 6 minutes. It is of somewhat simpler construction, the clutch being omitted. The third model is the "hour counter" which integrates on a cyclometer dial up to 1,000 hours in intervals of 6 min., or shorter intervals (say 1/100 hour) can be arranged for if desired.

The frequency meters to be exhibited are of two forms, the precision indicating and the master meter for determining the mean frequency for controlling the system frequency against time. A recently patented improvement enables the master pendulum to be separated from the indicating dials, so that the latter may be fixed in the control room in any convenient position, whilst the pendulum itself may be fixed at a suitable site.

Two new patterns of speed indicator are to be shown which have been supplied in large numbers to the Southern Railway for its latest electric coaches, and a road vehicle pattern which is being largely used for motor 'buses (illus.).

For checking the wave-form of a.c. supplies a precision moving-iron voltmeter is made, to be tuned to the frequency of the particular harmonic which it is desired to measure.

Evershed & Vignoles, Ltd.

Insulation testing sets include the latest development, the "Wee-Megger" tester, which weighs only 3lb. and is small enough to fit in the pocket. The "Meg" combined insulation and continuity tester is another recent addition to the group, and a specially interesting exhibit, to be shown for the first time, is a very low range earth tester for geophysical survey by the earth resistivity method (illus.). Investigation of the underlying strata can be made to a depth of about 1,500 ft.

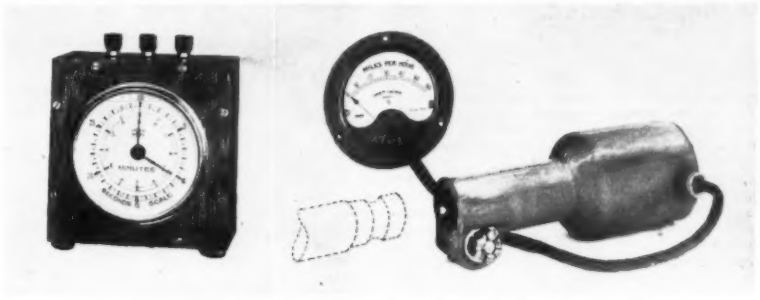
The C. & S. system of distant indication is to be shown for the first time. Variation in water levels or any mechanical motion, such as the position of gas holders, valves, dampers, etc., can be made to actuate the transmitter, which is of extremely simple construction. The indicator may be in the form of an instrument of a convenient size, or a series of coloured lights. The only moving part of the transmitter is a copper sleeve, which slides freely over a coil, so that the float or other device originating the movement is subjected to the minimum force. The movement of the sleeve varies the impedance of the coil over which it slides. For water level indication the copper sleeve and the float may be made in one unit, the coil, enclosed and sealed in a stainless steel tube, being immersed in the water. Alternatively, the transmitter may be operated by a suitable drive, such as chain and pulley.

The Evershed-Midworth distant repeater demonstrates the principles of remote indication, summation, and control, together with a typical application to a practical scheme. Several other instruments will also appear.

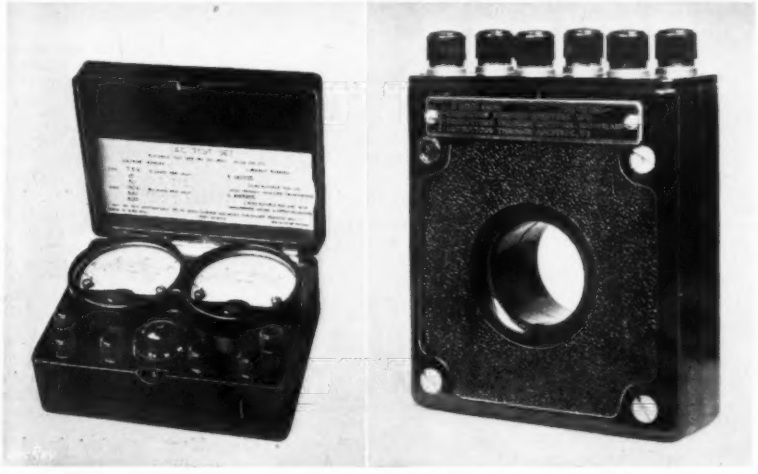
Ferranti, Ltd.

A wide range of 2½-inch instruments in uniform cases suitable for d.c. and a.c. supply, audio and radio frequencies, is made for switchboard use for mounting flush or projecting and in portable form for bench use; all cases are of moulded insulation.

Three-range voltmeters include an outstanding instrument reading 0-10-100-250 volts which is particularly suitable for a.c. valves and reads filament volts and mains and transformer voltages. It is also capable of use on d.c. at a slightly reduced accuracy, and has remarkably good damping characteristics. Protective resistances are included within the cases of all electrostatic voltmeters (described in our last issue, p. 929) to reduce damage due to burn-out on over-voltage.



An Everett-Edgcumbe time interval meter and speed indicator



A Ferranti multi-range a.c. test set and portable miniature current transformer

The d.c. multi-range test set (illus.) has become a well-known instrument for a wide variety of work. A somewhat similar instrument for a.c. contains a voltmeter and ammeter, the former having six ranges from 7.5 to 600 V, and the latter ranges of 0.5 and 5 A, so that any standard transformer may be used to increase the ammeter range definitely. The set is capable of use on 25 to 100 cycles and is calibrated on 50 cycles. It may also be used on d.c. at a slightly reduced accuracy.

Special miniature current transformers (illus.) are primarily for use in conjunction with 2½-in. moving-iron ammeters, and the a.c. test set described above. The combination makes an ideal method of measuring currents from 50 A to 200 A with first-grade accuracy. The standard transformer has a ½ A secondary and a self-contained primary with ranges of 25-10-2½ A; in addition, a primary may be inserted through the aperture to give ranges of 50-100-200 A. The transformer may be used on frequencies from 20-150 cycles, the accuracy at 50 cycles being within one per cent. with a maximum burden of 2 VA. When higher accuracy is required for metering (when phase angle is important) or when a higher volt-ampere output is required, the transformer can be fitted with a special core to give closer accuracy and a higher output. Where low current readings are not essential, the self-contained primary winding can be omitted and the transformer fitted with a special secondary, enabling an extension of range up to 500 A.

Connections are made to six insulated terminal caps mounted on the top of a moulded case, the terminals being clearly marked indicating their range and polarity. A name plate is fitted giving instructions for the winding of the external primary.

Synchronous clocks embodying a patented design of motor which does not make use of a permanent magnet are to be shown, together with a number of demonstration models.

Foster Instrument Co.

Instruments making their first appearance include a self-contained "foundry" pyrometer for the temperature measurement of molten non-ferrous alloys and aluminium, and a quick-reading thermometer specially designed for the use of jam boilers.

The new "Resilia" strip recorder is said to be a great advance on any existing instrument of the double-pivoted "direct deflection" type. A continuous chart is used having rectangular co-ordinates and lasting for one month's continuous working; it is 7 in. in width and at least 24 hours' record is always visible. Up to six records, each in a different colour, can be produced contemporaneously on the one chart. The driving mechanism is a specially designed electric clock, both d.c. and a.c. models being available; the arrangement is such that the recorder will continue to function for a considerable time after failure

The Evershed low-range earth tester

of the electricity supply, thus obviating lost records; the timing in the a.c. model is also independent of frequency.

While the standard chart speed is 15 mm. per hour, a "high" speed of 60 mm. per hour can be obtained simply by reversing the driving pinion, thus making the instrument suitable for both production and research work.

A. Gallenkamp & Co., Ltd.

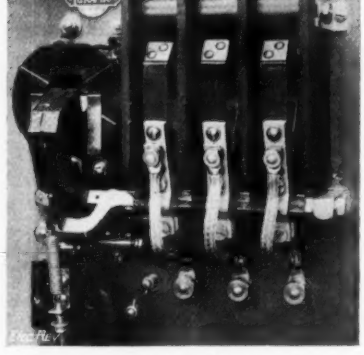
The chief exhibit will be a small electric muffle furnace with heating chamber of silica and nickel-chromium heating element. The furnace is fitted with automatic temperature control; the thermostat works on the expansion and contraction of a nickel or nickel-chromium tube, and operates an Igranic contactor switch on the control panel. The thermostat is very simple to adjust and can be set to maintain any temperature up to 1,000 deg. C. A pyrometer is not necessary to the operation of the thermostat and therefore the control outfit is not costly. The small furnace is most useful for general heat treatment of small parts, also for general purposes in works laboratories and technical institutes, and for heat-treatment research. An electrically heated drying oven, with automatic control, and a temperature range of 50 to 300 deg. C. will also be shown, this being a general purpose oven for laboratories for heat tests.

Gambrell Bros., Ltd.

This selection of measuring instruments will consist of wavemeters, variable condensers, capacity bridges, low inductance resistance boxes, &c., and a complete range of d.c. testing instruments.

Henry Hughes & Son, Ltd.

These aeronautical and marine navigational devices include a new aircraft telecompass in which the directional ele-



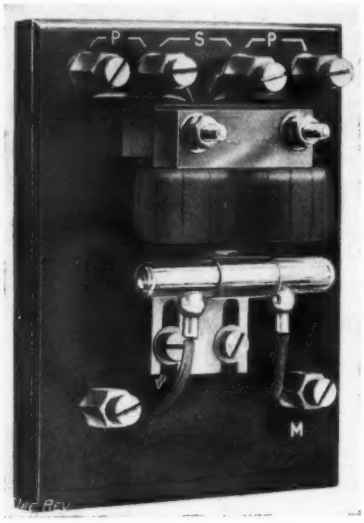
An Igranic 100-A latched-in contactor

ment is magnetic and is used to alter the liquid resistance in two parallel circuits through the compass liquid; the current in these circuits is used to operate differential milliammeters which indicate whether the aircraft is on the set course, or, if not, to which side it is heading. A relay can be supplied with the compass to operate indicating lights as soon as the aircraft deviates from the proper course.

Magneto-striction echo marine sounding gear utilises the property of certain metals, which, when placed in an alternating magnetic field, undergo change of dimensions during each cycle of the magnetic change. The alternating magnetic field is obtained by the discharge of a condenser through an inductance wound over the magneto-strictive transmitter, which is in contact with the water. The outgoing wave of relatively high frequency is reasonably directional and the reflected echo from the bottom is received in a similar apparatus tuned to the same frequency. The incoming impulses set up currents in the inductive winding and these are amplified and passed to the recorder.

Igranic Electric Co., Ltd.

A range of silent a.c. contactors (illus.) for heating, lighting, and other circuits has recently been developed for automatic operation by thermostats, time switches, or other devices, or for remote control by push-buttons. Since the operating magnets are only excited momentarily at closing and opening, this new series is guaranteed to be free from a.c. hum. No current is consumed in the magnet while the switch is closed, so that these contactors are economical to operate on



An Isenthal mercury switch

the continuous service encountered on electrical heating installations.

Substantial laminated brushes are employed, protected by easily renewable sparking tips. Arcing shields of ample size confine the arc, which is cooled by a large arc splitter. Standardised single-, double-, and triple-pole switches from 25 to 400 A for a.c. voltages up to 550 and larger capacities are under development.

The No. 1011 "Across-the-line" push-button contactor starter with thermal overload protection for a.c. squirrel-cage motors up to 7½ h.p. is another example of recent development of this type of starter. The eutectic alloy type of thermal overload relay, which may be in two or three phases of the motor circuit, is reliable and consistent. Examples are to be shown with and without overload protection and push-buttons, or separate push-button stations may be used; alternatively, the motor may be automatically started and stopped by a pressure, float, time, or other master control device.

There will also be a number of additions to the already very wide range of auxiliary and master control devices manufactured by this company. A new triple-pole pressure operated switch is to be shown for the first time, together with a new gauge type pressure switch and relay, and other pressure-operated master devices that make motor driven air and gas compressors completely automatic in operation.

Isenthal & Co., Ltd.

Resistances, voltage regulators, control apparatus, and mercury switches (illus.) will be the principal items. There are the simple unprotected types for non-inductive loads, protected types for more difficult load conditions, and especially the non-tilting plunger types for the great majority of technical and engineering applications.

There will also be a number of relays used in connection with such switches for thermostatic and other temperature control; relays and control mechanism (embodying mercury switches throughout) for humidity control by means of hygrometers or psychrometers, which are so sensitive that by merely breathing on the instrument the control motor is set in motion.

The "Chronostat" automatic electric humidity controller utilises a hygro or psychro transmitter to influence two relays, one of which operates when there is an excess of humidity and the other relay when the humidity falls below a certain point. Both are electrically interlocked. The hygro or psychro instruments are put under current at intervals of a few minutes by means of a time switch, so that the room in which the instrument is situated is periodically examined automatically for its humidity. If this factor is too large or too small, one or the other relay works and a motor is switched on in one or the other sense of rotation; this motor actuates through suitable gear the steam or water valve and thus governs the amount of humidity which is desirable for the room or factory in question. When this valve has entirely opened or completely shut, provision is made by limit switches to break the motor circuit in that particular sense of rotation, but it is also possible to provide further contacts in relation to the end positions or in any other intermediate position for the operation of additional ventilators or heaters, opening and closing throttles, the control of gas taps, the interlocking or unblocking of electric circuits, etc.

London Instrument Co., Ltd.

This concern is to exhibit laboratory equipment, models of two new electrical distribution boards therefor, and a new ruler with an electrical indicator for drawing accurate tangents to graphs for the purpose of differentiating.

Claude Lyons, Ltd.

The new Jenkins and Adair condenser microphones are ultra-sensitive and have good frequency characteristics throughout the useful spectrum. A new battery-operated heat-frequency oscillator, which is self-contained, will be demonstrated; also an output power meter; an improved standard signal generator for the precise measurement of the sensitivity, selectivity, and fidelity of radio receivers; and a variety of sensitive "Visitron" photo-electric cells of American manufacture.

Marconiphone Co., Ltd.

Several broadcast radio receivers are to be on view, complete and in chassis form. Model "256" uses seven valves and a superheterodyne band-pass circuit, with variable-mu valves and tone control. The battery-operated set has six valves and simplified control, and to the radio-gram new automatic record changing mechanism has been fitted. The "Midget Mains" six-valve set is illustrated.

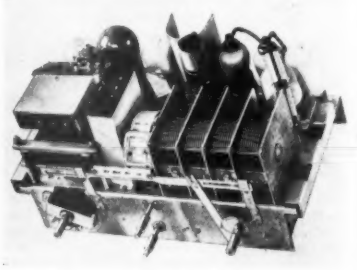
A new model pick-up is fitted with a metal base and screened connecting leads. Permanent-magnet and moving-coil loud speakers will be shown, and a selection of valves will include the new P.T.4 directly heated 8-W pentode and the new PX.25 and P.T.25 25-W output valves.

Marconi's Wireless Telegraph Co., Ltd.

Light-beam telephony apparatus is to be demonstrated, together with a valve diathermy outfit for producing medical and surgical high-frequency currents. Amplifying equipment, with flat response characteristics over a wide frequency band has been designed specially for television scanning systems. There will also be portable apparatus for reproducing pictures at a distance; marine radio telephone equipment; and a device for receiving visual course indicator signals on aircraft.

Mercury Switch Manufacturing Co., Ltd.

A selection of mercury switch tubes will include a magnetic relay having a vertical tube with electrodes entering at the top and bottom, their points being



The Marconiphone six-valve "Mains Midget"

divided by a double quartz glass cup and connected together by a solenoid which normally floats upon the top of the mercury. When pulled down by a special electro-magnet it causes the level of the mercury to rise until the point of the upper electrode is immersed, thereby completing the circuit.

M.O. Valve Co., Ltd.

At the present time the company produces about 250 different types of valves, the more interesting developments including water-cooled transmitters, e.h.p.

rectifiers (illus.), and comprehensive ranges of the small "domestic" types.

Cooled-anode valves represent a considerable advance in the field of thermionics. The 500-kW valve is said to be the largest single-unit sealed-off valve in the world. For short-wave radio communication there are special cooled-anode types. A further development in this connection is the split anode magnetron type E.396, which is capable of producing oscillations from the lowest audio frequencies to approximately 300 by 10^6 cycles (1 metre wavelength), the valve being operated between the poles of an electromagnet. This type can be used as an electronic oscillator for wavelengths down to about 20 cm.

Extra-high-voltage rectifiers as used chiefly in radiography, cable testing, and dust precipitation plant are to be shown, and further exhibits will include a selection of large glass molybdenum-anode valves, repeater valves, rectifiers for general broadcast receiver work, and mercury-vapour rectifiers.

Nalder Bros. & Thompson, Ltd.

A complete series of new miniature instruments with long circular scales for use where panel space is limited, known as the "Bijou" L-type, are constructed according to the Lipman patents, with 2½ in. and 4 in. dials. They include wattmeters (illus.), reactive kVA meters, voltmeters, and ammeters, giving an angular deflection of about 300 deg. and power factor meters with 360-deg. scales.

The 2½-in. instruments have a scale length of over 5 inches and the position of the pointer can be clearly seen at a distance of 40 to 50 ft. This size of instrument is fitted in a black moulded "Bakelite" case either projecting or flush pattern. The 4-in. instruments have a scale length of over 8 in.

The wattmeters, voltmeters, and ammeters are spring controlled and fitted with external zero adjusters. The voltmeters can also be arranged with "set-up" scales and the wattmeters and reactive kVA meters with centre zero scales. All "Bijou" L-type instruments comply with B.E.S.A. Specification No. 89 for first-grade accuracy.

A direct reading single-element power-factor meter has recently been developed to facilitate the analysis of circuit conditions of a.c. systems. It consists of fixed current and voltage coils and a very light moving-iron system to which the pointer is attached. The combined electro-magnetic effect of the current and voltage coils upon the iron armatures is such that for any given "power factor" the moving system is automatically in neutral equilibrium, and it is so independent of the magnitude of the load. The meter indicates "incoming" power on the upper half of the scale and "outgoing" power on the lower half.

Of special interest among protective gear is the "CM" overload relay for the protection of large direct-started induction type motors, whereby special starting gear is avoided, as described in our December 2nd issue.

A "Nalder" bijou wattmeter

Negretti & Zambra, Ltd.

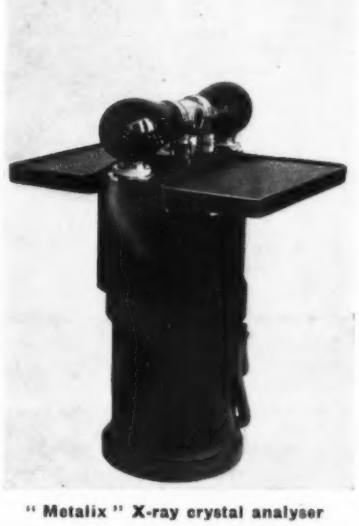
Among electrical thermometers and thermal electric contact devices there is to be a temperature controller for electric furnaces and ovens which incorporates a resistance or thermocouple pyrometer. Regulation is effected by mercury tube switches. A trigger device driven by a small synchronous motor keeps one switch continuously in circuit until the next one comes into operation. The single-switch controller is suitable for 115A at 200 V and temperatures up to 1,400 deg. C.

W. H. Pettifor

This range of electrical aids for the deaf of various pitches, possessing different wave-form characteristics, includes a number of proprietary instruments. There is a test instrument which enables a prescription to be written for an electrical aid to give the most suitable pitch, wave-form, and volume of sound for each individual case of deafness as well as a test set for comparing the respective merits of a wide range of proprietary instruments for individual cases of deafness. A number of new electrical and mechanical instruments will be shown, included in which are light-weight electrical aids.

Philips Industrial, Ltd.

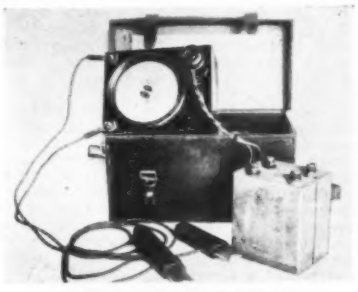
The self-contained shock-proof "Metalix" apparatus for X-ray crystal analysis by the Debye, Scherrer and Seemann-Bohlin methods has been improved since last year (illus.). The line-focus tube for crystallographic research work embodies complete protection against unwanted X-radiation. There is a uniform distribution of the electrical load. Two of the four windows show the line focus reduced in its dime[illegible] to a square, which is well suited for camera work when diaphragms with circular openings are used. The other two windows show the focus as a narrow rectangle, in which form it is best for use with slot diaphragms.



"Metalix" X-ray crystal analyser

The "Metalix" (200 kV) X-ray tube and stand for industrial radiography forms part of recently developed shock-proof apparatus for the examination of welds and other metal structures by the absorption method. A sodium lamp and rectifier has been specially designed to give a source of high intensity for methods of analysis involving the use of polarised light. A recent development is a water-cooled e.h.p. valve, which is designed to rectify up to 125 kV peak and to deal with 200 mA continuously. By means of apparatus for testing precious stones, which projects a beam of X-rays through a pearl, a characteristic diffraction image (in this instance hexagonal) can be recorded on a photographic film. Cultured pearls, due to the different structure of the core, yield a four-sided figure.

A new valve time switch for controlling radiographic exposures involves the use of a three-electrode valve arranged in circuit with a resistance and capacity. A range of photoelectric cells for industrial and scientific purposes, including cinematograph "talkie" apparatus, will be shown, both of the high vacuum and gasfilled types. Modern "talkie" apparatus and some examples of Philips public address equipment will also be on view. "Barretters" (regulator lamps) have their resistive properties so arranged that when the voltage applied to the filament increases within certain limits, the resistance increases at the same rate and hence the current passing remains constant. The company's exhibit will also include hot cathode relay tubes.



The Record continuity tester

W. G. Pye & Co.

A portable electro-cardiograph will be on view, together with a Kerr Grant electrometer; a Bragg X-ray ionisation spectrometer; a photogoniometer for crystal setting and X-ray crystal photography by the simple means of changing components; potentiometers, bridges, galvanometers, lamps, and scales.

Record Electrical Co., Ltd.

The "Minor" insulation testing set weighs only 3¾ lb., and its size is 5⅛ by 4¼ by 3½ in. The height is such as to allow full swing of the generator handle. A carrying handle is provided on the side of the moulded "Bakelite" case. The unit system of construction enables each of the three component parts to be replaced without interfering with the others. The generator gives a steady two-wave voltage and circuit current of 7 mA when the insulation is zero. The indicator is of the moving cross-coil type. The standard instrument is built for 500 V, and has a clear open scale, 2½ in. long, reading 0-20 megohms and infinity.

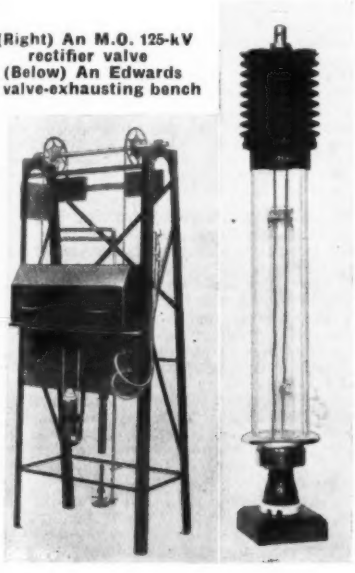
The company's continuity tester (illus.) has been designed to comply with I.E.E. regulations. It consists of a "Cirscale" indicator, with nickel-iron battery and connecting leads having steel spikes, housed in a convenient carrying case. The scale is 8 in. long, readings as low as 0.002 ohm are clearly defined, and resistances up to 5 ohms can be measured without changing the scale range.

"Cirscale" a.c. and d.c. instruments, electrical tachometers, portable instruments, and an electrical type of distance indicator for registering specific gravity or density of liquids will also be on view.

Salford Electrical Instruments, Ltd.

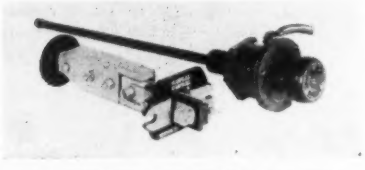
Among measuring and testing instruments will be a valve ohmeter for insulation or resistance testing. It is plugged into a.c. mains, the d.c. output at 500 or 1,000 V being applied through a moving-coil instrument cali-

(Right) An M.O. 125-kV rectifier valve (Below) An Edwards valve-exhausting bench



brated in ohms. An application of a l.f. choke coil with a magnetic core composed of stampings will be demonstrated in the compact filter unit known as a "hum eliminator" for use with radio sets which are to be run from d.c. mains supplied from mercury rectifier substations.

Protective relays as recently supplied for the grid include overload and leakage induction disc types having inverse time characteristics; overload and leakage attracted armature patterns, instantaneous in action, which have the extremely low consumption of 0.05 VA at the operating current; constant time relays; reverse power relays; moving-coil relays; and reversed and broken phase



Two Salford thermostats (R.5 and rod type)

relays, an adaptation of the reverse power relay.

In the thermostat group, all dependent for their action on the differing coefficients of expansion of various materials, the rod type (illus.) is suitable for controlling the temperature of liquids within very fine limits, and will operate within 1° F.; it must be used in conjunction with a relay for controlling heavy currents. The R.5 thermostat (illus.), both fixed temperature and adjustable patterns, which will control 15 A a.c. or d.c. on circuits up to 250 V, is a bi-metallic thermostat incorporating a permanent magnet which, in addition to giving a quick make and break action, also supplies a powerful magnetic blow-out to rupture the arc. The room or air thermostat is somewhat similar in operation to the standard rod type, which depends for its action on the difference in expansion between a rod of invar and a brass tube. The T.1, however, is for use for temperatures up to 800° C., and the invar rod and brass tube are replaced by a quartz rod and nickel tube. This thermostat is also capable of controlling circuits of 15 A up to 250 V.

R. M. Catterson-Smith

A high-temperature electric furnace for hardening high-speed steels has a much larger heat-dissipating area than usual for so small a furnace. Small laboratory furnaces will include a crucible for 1,250 deg. C., fitted with an embedded steel alloy winding, and a "fire" will illustrate the use of refractory and ceramic materials for domestic heating, the element being protected from the cooling effect of air currents.

Standard Telephones & Cables, Ltd.

Portable cathode-ray oscillographs are to be demonstrated and an audio-frequency oscillator and testing equipment that is mains operated entirely. Other instruments are an oscillator and direct-reading set for measuring transmission gains of 40 db and losses of 30 db; a special outfit for determining the irregularities in timing to which telegraph signals are subject; a capacity unbalance set and auxiliary condenser box for testing toll telephone cables in order to reduce cross talk; a portable "Weston" illuminometer which permits light intensity to be measured direct without comparison with standards; photo-electric cells and relays; thermocouples; thermionic repeater valves and "Micromesh" detectors and amplifiers.

H. W. Sullivan, Ltd.

Equipment for radio-frequency precision measurements, high-frequency a.c. measuring apparatus, telephone cable, and d.c. testing devices with accessories will be on view.

Synchronome Co., Ltd.

Besides a master controlling pendulum clock, a half-seconds free pendulum will be arranged to transmit seconds and half-minute impulses, the magnet on the pendulum operating in one direction only.

For electric power stations there is a frequency checking clock, with which may be incorporated a wireless receiving set permanently tuned to Daventry (5XX) and arranged to be automatically switched into service when the Greenwich time signal is broadcast.

Telegraph Construction & Maintenance Co., Ltd.

This exhibit will include insulating materials for submarine communication cables, such a "K Gutta," "Teleconite" gutta-percha substitute, alloy wire, strip, loading coils, and resistance and heat-resisting materials.

H. Tinsley & Co.

Time and frequency measuring equipment, audio and radio-frequency instruments, with components and accessories, including students' measuring and a.c. and d.c. testing sets, are among the firm's exhibits.

Venner Time Switches, Ltd.

A large range of time switches is to be shown for the control of shop window, street, telephone kiosk, and staircase lighting and school and factory programmes. The clocks fitted can be hand or electrically wound, or where controlled frequency is available a Venner synchronous motor may be fitted.

Among relays in various forms the "W" is for off-peak water heating, and relays developed to operate G.P.O. telephone kiosk lighting at distances up to twenty miles from the exchange operate over the existing Post Office telephone conductors.

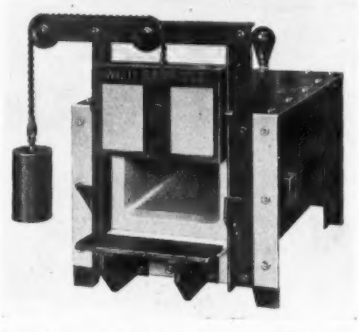
The Type A19 stop-watch with full scale reading of 10 seconds enables the user to read to 1/40 second. This movement is used in the electrically operated stop-watch, another new development. The Marconi time switch, which answers all the requirements of Trinity House, embodies automatic adjustment to standard time.

There will be a buoy lamp to assist in under-sea cable repairing, and a direction-finding watch compass for navigation both in the air and on sea. House service prepayment. fixed and running charge, and rent collection meters have been developed during the past twelve months, and a coin collector is being made to assist in the collection of rentals from the small consumer.

A new burglar switch is designed to switch off a burglar alarm after about 3 to 5 minutes to comply with the new L.C.C. regulations

Westinghouse Brake and Saxby Signal Co.

In addition to the now well-known range of a.c. measuring instruments employing metal rectifiers in conjunction with moving-coil elements, examples are to be shown of the company's metal rectifiers having very small dimensions. which are intended to reduce the stray electrostatic capacity present in the existing types and make it possible to extend the working range of these instruments



A Wild-Barfield laboratory muffle furnace

to include a frequency range of at least several kilocycles. At present, however, such rectifiers are not in production, but are shown only as examples of a laboratory product.

The copper-oxide photo-electric cell shown at the last exhibition, which had a maximum sensitivity in the infra-red part of the spectrum, is now available in a commercial form. In addition another type has its maximum sensitivity in the green portion of the spectrum, but is not yet in production.

Rectifiers which have been placed on the market for the anode supplies of mains driven radio receivers include new models which provide the bigger outputs required for modern receivers using, in general, the field of a moving-coil loudspeaker as a smoothing choke, and necessitating a very high voltage output from the mains rectifier. There will also be exhibited a completely new range of low-voltage trickle charger types of metal rectifier.

Metal rectifiers are now readily applicable to high-voltage dust precipitation plant, and several equipments have been built up to voltages of the order of 100,000. They are similarly a convenient method of providing high voltage d.c. for physical processes, such, for instance, as cathode sputtering, and an example is to be shown of such a plant at work. A metal rectifier will function as an energy absorber in place of a field discharge resistance for an inductive circuit, and will serve in precisely the same manner without necessitating any special switchgear.

A Zenith sliding transformer

Weston Electrical Instrument Co., Ltd.

Laboratory standard instruments, portable standard testing outfits, including sets suitable for radio service; photronic devices, cells, relays, illumination meters, a universal exposure meter for still and motion picture photography, with typical movements and parts will be seen.

Wild-Barfield Electric Furnaces, Ltd.

A modified form of electric furnace with forced air circulation suitable for all temperatures up to 700 deg. C. is to be on view. The main change is in the centrifugal fan together with slight changes in the interior construction, which by reducing resistance to air streams have increased the output by 35 per cent. For operating in conjunction with this furnace there is a Wild-Barfield-Foster charge progress recorder, which controls and records the temperature and on the same chart gives a record of the rate of heating of the charge itself, and shows when the desired temperature has been reached.

Electric solder bolt heaters reduce oxidation of the copper bits, and eliminate "pitting" due to deleterious gases which are usually present. Laboratory muffles (illus.) with normal nickel-chromium elements are suitable for temperatures up to 1,000 deg. C., whilst with platinum or molybdenum windings temperatures up to 1,400 deg. C. and 1,700 deg. C., respectively, are obtainable.

"Telcon" electric resistance materials are manufactured in three grades, "Pyromic," "Calomic" and "Telconstan," and are produced by the Telegraph Construction & Maintenance Co., Ltd.

Zenith Electric Co., Ltd.

New designs of sliding resistances will be shown mounted on steel and porcelain formers for front-of-panel and back-of-panel mounting, with automatic clutches to prevent overturning. Laboratory resistances for the control of voltage and current in electric furnaces and other circuits have special ventilated enclosures, eliminating all danger of shock. Also a large range of alternative types have non-inductive and capacity free windings.

Transformers of novel design, with sliding contact adjustment (illus.) give complete control of secondary voltage from zero to the maximum. Phase shifting current and potential transformers, together with a complete testing equipment for comparing, recording, and integrating wattmeters, power factor indicators, and other electrical measuring instruments will be demonstrated.

Rural Sub-stations.

Some examples of modern practice

By F. GURNEY, A.M.I.E.E.

IN an earlier article* the principles underlying the design of a 33-kV main transmission scheme for supplying a rural area were considered. The present practice in laying out high-voltage sub-stations is dealt with in the following notes. In the accompanying diagram of a typical sub-station, with two step-up transformers and six radial feeders, A1 with A2 and D1 with D2 form pairs of feeders carried as six-wire lines on single supports, while B and C are separate single feeders. The station is in two halves, the only connection between the two halves consisting of a three-phase busbar supported at each end by the post insulators of an isolating switch without any intermediate supports. When one half of the station is shut down supply will be maintained on the system by using the alternative supplies provided by the duplicate feeders and the outer ring main. The circuits of a duplicate feeder are thus shown connected to opposite halves of the station, while the feeder switches are so disposed that the outgoing lines can be connected to the station without the crossing of a line over another or over the station.

Switching on the Low-voltage Side

The important alternative to the 33-kV station is the system of arranging for all automatic switching to take place on the l.v. side by providing a separate step-up transformer for each radial feeder. The existing station switchgear will be extended by adding the same number of switches as there are feeders. Each switch would be connected by paper insulated cable to an outdoor-type transformer arranged with 33-kV porcelain bushings for bare connection through an air-break isolator direct to the line. It will be seen that whereas the 33-kV station for six feeders requires eight 33-kV oil circuit breakers, two l.v. circuit breakers, and eighteen 33-kV isolators, the alternative requires the much smaller number of six l.v. circuit breakers with possibly a bus-section switch and six 33-kV isolators.

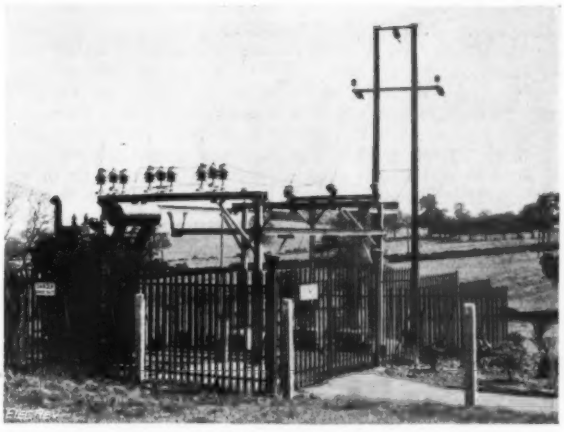
This, however, is not necessarily all gain, as the l.v. circuit breakers may form part of expensive double-bus metal-clad units of a high rupturing capacity. The scheme offers considerable saving in capital cost and has few disadvantages. The most serious of these is that the total kVA of transformers in use is likely to be larger than that of the other scheme, and the iron losses will be greater. There will also be an increase in the frequency of transformer switching, but pressure rises caused thereby are not likely to damage a transformer

A circuit breaker equipment in a with reclosing kiosk

generously designed. The l.v. feeder switches would be equipped with overload and leakage relays. The necessary leakage protection for the overhead line is obtained by adding another leakage relay connected to a current transformer in the neutral of the 33-kV side of the transformer.

The transformers in this case should be fitted with "on-load" tap-changing equipment electrically operated from the

*ELECTRICAL REVIEW, December 2nd (page 808).



A step-up transformer station five miles from the power station

control board in the main station, providing means for the individual adjustment of the feeder "sending" voltages. With either of these schemes the whole of the switchgear which will automatically cut out a faulty circuit is under the continuous control of attendants, who will immediately try to restore supply and in the majority of cases they will succeed.

Unfortunately there will be many cases where neither scheme is practicable, because the supply station is so situated in an industrial district that, even if the site can be extended, overhead transmission cannot be started from the site. Cables operating at 33 kV are reliable, but their cost will probably prohibit their use as means for connecting the transmission scheme direct to switchgear at the supply station. The alternative of transferring the step-up transformers to the positions where the overhead lines start is much more likely to be adopted, where all paper cables required operate at the lower pressures of 6,600 or 11,000 V. The removal of these transformers to other sites increases the cable connections between station switchgear and transformers to the proportions of feeder sections, and additional l.v. switchgear at the new transformer sites can hardly be avoided. In the case of the single-circuit feeders one oil circuit breaker only will be needed, and although this would be sufficient for each feeder in the case of those run in duplicate over the same route, increased flexibility would be obtained by providing other switches for interconnection of the feeders on both l.v. and h.v. sides of the transformers.

Housing the Gear

Thus for this arrangement two incoming switches, two transformer switches, and a bus-section switch would be required on the l.v. side, while two transformer switches, two outgoing-line switches, and a bus-section switch would be required on the h.v. side. The h.v. switchgear would be of the air-break type erected with the transformers within a fenced-in area. By far the most convenient arrangement for the l.v. switchgear would be the provision of a brick sub-station to house sheet-steel cubicles or truck switchgear, and giving accommodation for engineers handling and testing the equipment. A cheaper alternative could be found in the sheet-steel kiosk. The necessary requirement of providing a compartment as a shelter for men "standing-by" should not be overlooked.

The combined transformer and line protection would consist of the usual overload and earth leakage with the additional earth leakage protection for the overhead line. With pilot cables available the "Translay" scheme of feeder protection can be used for the underground feeder sections. It is comparatively inexpensive, as there are no special requirements in regard to pilot cores, and it will operate from ordinary current transformers. Without pilot cables graded minimum time limit relays could be employed at the supply station and the transformer sub-station. Again, with pilot cables "on-load" tap-changing equipment could be retained for remote control at the supply station of the 33-kV line voltages. The provision of private telephones is possible with pilot cables.

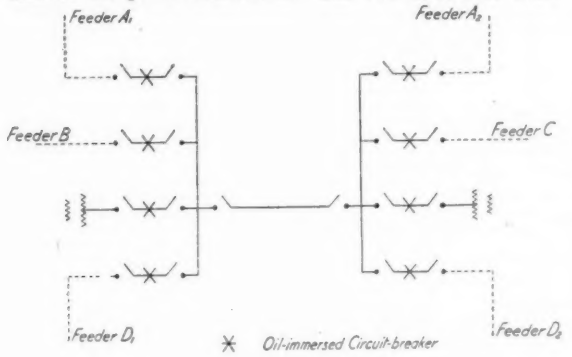
Transformer-switch Reclosing Equipment

With the altered switching arrangements an overhead-line fault will open a switch where attendants are not normally present to reclose it. A remedy can be found with the pilot cable, as the protective relay or relays at the transformer station can be made to operate the tripping circuit of the feeder switch at the supply station, restoring control of the overhead line switching to the station staff, except when an operating engineer requires to have automatic control at the

transformer station for fault localising or testing. Without pilots another remedy is available in a re-closing equipment for the transformer switches. This equipment in kiosk form is illustrated on page 961. The oil circuit breaker is motor operated, the motor being controlled by contactors energised by a reclosing relay, which is adjustable to give a maximum of four reclosings at intervals of about 30 seconds before locking out. Should a fault clear itself before the lock-out stage is reached the relay resets, so that the full number of reclosings is available for the next operation on a line fault.

Another picture on page 961 illustrates a step-up transformer station feeding a single-circuit overhead line removed from the supply station a distance of some five miles. A pilot cable has been laid with the main cable, and it is used for "Translay" feeder protection, remote operated "on-load" tap-changing equipment on the 1,000-kVA step-up transformer, and a telephone. The l.v. switchgear is of the truck type housed in a brick building. A local supply is given from the sub-station at 6,600 V, so that three trucks are required instead of one, viz., an incoming truck, a transformer truck, and a feeder truck. A single phase 110-V supply for operating the tap-changing gear is obtained from a small transformer protected by fuses and fixed in the movable portion of the incoming feeder truck.

Referring to the pictures on page 951, fig. 6 illustrates the outdoor equipment of a transformer station for duplicate feeders, which leave the sub-station as a six-wire line; the underground cables at 6,600 V are equipped with "Translay" feeder protection. The 6,600-V switchgear is housed in a brick sub-station, and consists of five trucks for two incoming feeders, two transformers, and a bus-section switch. Each transformer switch is equipped with overload and leakage relays with an additional earth-leakage relay operated by a current transformer in the h.v. neutral. This current transformer is in the tank of the power transformer. The two 1,000-kVA trans-



A sectionalised duplicate-feeder line and transformers

formers are equipped with "on-load" tap-changing gear, which is operated from the supply station some two miles away. It will be noted that the h.v. switchgear consists of two transformer switches, two line switches, and a bus-section switch.

Types of Outdoor Sub-stations

Switchgear on the overhead transmission system will be required for two purposes—sectionalising the system and controlling step-down transformers. Non-automatic air-break switches will fulfil all the conditions of the former, provided that those switches which are required to operate as circuit breakers, as distinct from isolators, are of a type capable of performing the onerous task of disconnecting a long length of open-ended transmission line. On the other hand, whereas the air-break circuit breaker is suitable for switching transformers in and out by hand, means for automatically disconnecting the transformer must be provided. Fuses are cheap and effective for this purpose.

Because the oil circuit breaker has been insisted upon for automatic operation in the case of the control of an overhead line the two conditions should be compared. Where separate l.v. protection is provided only, a transformer breakdown should operate fuses, for the purpose of the fuses is not to protect the transformer so much as to protect the line from the transformer, and for this reason the limit in size of fuse should be based on the setting of the feeder protection rather than on the size of the transformer. No question of frequency of operation on transformer circuits would arise, such as that which makes fuses on overhead line circuits an inconvenience, an expense and an obstruction to the efficient operation of a system. The omission of earth leakage protection on the transformers is not likely to become a public danger of the sort to prevent which the regulation previously referred to was made.

Some simple arrangements requiring two or three air-break switches can be carried on ordinary wooden poles. In the two-switch arrangement needed for tapping a duplicate feeder circuit with switches mounted on a four member pole, either line can be connected through one of the switches to a common busbar feeding the transformer through a set of fuses. The two switch operating handles should be interlocked so that the consumer cannot close both switches together, although it should be possible for the supply authority's engineer to do this when it is desired to change over the supply without an interruption. With the three-switch arrangement on a four-member pole to "loop-in" a single circuit ring main, the consumer cannot be given any control of the line switches.

In the case of the duplicate feeder circuits provision for sectionalising the lines in addition to controlling a transformer or transformers increases the number of switches required and pole supports become impracticable. Of the types of outdoor sub-stations distinguished by the conventional designations "high" and "low," the "high" type is generally the more economical, where no oil-immersed circuit breakers are required. The air-break switches are carried on steelwork, which is high enough to permit the placing of switches at two levels, and high enough and strong enough to terminate the overhead lines at normal line height with the line poles kept a span length away.

The diagram on this page shows the arrangement of sectionalising a duplicate feeder line and connecting two step-down transformers. Fig. 4 illustrates a sub-station connected in this manner containing two 500-kVA transformers stepping down the supply to 11 kV for a secondary system of distribution. Fig. 5 illustrates an interesting example of a more elaborate sub-station, which receives two independent incoming single circuit supplies at 33 kV, controls two sets of outgoing duplicate feeder six-wire lines, one transformer to supply an 11-kV secondary system, and another transformer to give a local l.p. supply.

Statutory Requirements

Both the Home Office and the Electricity Commissioners have regulations affecting the design of a rural electrification scheme. Some, if not all, outdoor sub-stations come within the definition of Electrical Stations, Part 1 (20), of Schedule VI of the Factory and Workshops Act, 1901. This definition refers to "premises in which electrical energy is generated or transformed." It is not clear whether an outdoor switching sub-station without generators or transformers is a "factory" within the meaning of the Act, or whether a transformer mounted on a pole constitutes "premises." If these do not come under the Factory and Workshops Act there are no parallel regulations by the Electricity Commissioners, but, as some may be published, consistency in the design of all types of sub-stations is desirable.

In the outdoor sub-stations illustrated live metal is arranged at such a height from the ground that it would be impossible for an operator to come into contact with any live part inadvertently. The transformers are erected on concrete plinths to lift up the terminals above ground to not less than 9 ft. Furthermore the concrete plinths fit the transformer bases, so that no platform exists around the transformers. Fig. 2 clearly indicates an attempt to obtain large clearances between the position necessary for a man to occupy for changing fuses, and the live side of the switch used to isolate the fuses.

Sectionalising Switchgear

On the question of sections much depends on the consumer, as to whether it is necessary to design so that maintenance work can be carried out in sections. Fig. 2 illustrates a sub-station which must be completely shut down for maintenance, but it supplies a factory working a normal five and a half day week, so that this can be arranged. On the other hand, some types of consumers would require a sub-station divisible into sections so that supply could be maintained. Typical of this type is the bulk supply to a town, where increased cooking and heating load is robbing the maintenance engineer of an opportunity to disconnect the supply on Sunday mornings. Fig. 3 shows a terminal station fed by a six-wire line for a town distribution. Each line terminates on a separate steel structure. The interconnection between the two consists of three copper tubes supported at each of the insulators of isolating switches. With both sets of isolators open one half of the sub-station can be made dead for maintenance with clear separation from the "live" half.

Fig. 1 is an excellent example of a switching station arranged for separation into two halves for maintenance. The station receives two incoming feeders and controls four outgoing feeders with a cross-over switching arrangement.

The author wishes to acknowledge his indebtedness to the Metropolitan-Vickers Electrical Co., Ltd., for permission to publish these illustrations of their equipment.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

A Strong Case for Main-line Electrification

THE paper which Mr. J. M. Kennedy read before the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS in London last week shows the extent to which railway electrification has been carried out in different parts of the world.

Of the 11,500 route miles at present electrified, or under construction, approximately 6,200 or, say, 55 per cent., are d.c. and the remainder a.c. Of the d.c. systems, 1,300 route miles are equipped with a third rail and approximately 5,000 miles with overhead equipment, and of the latter 2,200 miles are at 1,500 V and 1,900 miles at 3,000 V. Of 4,800 route miles equipped since the war, more than 66 per cent. are d.c., and the bulk of this operates at 1,500 V or over. This is fairly definite evidence in favour of d.c. at 1,500 V (or 3,000 V), confirming the recommendations of the Kennedy and Pringle Committees.

[*Elliott & Fry*

Mr. J. M. Kennedy

The Suitability of British Lines

British lines have a comparatively high traffic density and are therefore far more suitable for economical conversion than lines in other European countries, but the potentialities have been ignored owing to an almost pathetic adherence to the effete steam locomotive. Over the next twenty years the railway demand might well amount to 20 per cent. of the total of other electrical requirements of the country, and would consequently have an appreciable influence in reducing the cost of electricity. In view of this it appears reasonable to assume that supplies (at, say, 33 kV) would be available at the railway sub-stations at a " grid price " of £3 per kW plus 0.2d. per kWh throughout the country. Taking 50 per cent. load factor, the cost delivered to the sub-stations would be 0.365d. per kWh. Sub-station losses increase this to 0.402d. and annual charges on sub-stations to 0.527d. kWh, which is the cost delivered to the track. The final result would be that the cost of energy delivered to the pantographs at 50 per cent. load factor would be 1.073d. per kWh.

Approximately half the cost of electricity as delivered to the trains is made up of annual charges and losses in the overhead equipment of the tracks, assuming that transmission is at 1,500 V. In view of this high cost the author made an investigation into the relative costs of 1,500- and 3,000-V d.c. electrification. Taking copper at £50 per ton, the gross saving on overhead equipment and losses amounts to £435 per single track mile at a traffic density of three million track ton miles per running track mile per annum, and increases to £495 per single track mile at 4.5 million ton density. Against this the extra cost of the 3,000-V tractor equipments amounts to £300 and £370 per single track mile for the same traffic densities, and the net saving from the use of the higher voltage would appear to be in the neighbourhood of £130 per single track mile between the limits of traffic density above mentioned. With copper at its present price of £40 per ton, however, there is little chance of any economic advantage to be expected from the higher voltage, but from the operating point of view it would undoubtedly give more flexibility.

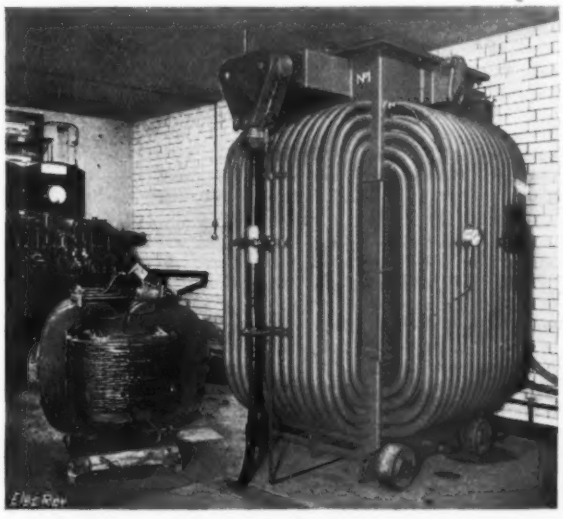
The Weir Committee's Figures Brought Up-to-Date

An estimate of the results of electrification based on 50 per cent. of the route miles carrying 60 per cent. of the traffic (and the percentage would probably be considerably in excess of this) shows that the resultant saving would be sufficient to produce a surplus of at least 5 per cent. on the capital expenditure after meeting all fixed interest and sinking fund and other costs and charges. Any such statements are, however, unimaginative, as they leave out of account many advantages which will accrue from electrification, the financial effect of which it is impossible to assess.

Judged from the national point of view, the return which can be expected from a comprehensive scheme of railway electrification over twelve years is not the somewhat meagre figure of 7 per cent., but something very much nearer 15 per cent. The present decline of traffic figures does not bear directly on the question of electrification, for whereas the gross receipts are down by over 20 per cent., the engine mileage and working expenses have only been reduced by 8 per cent. or 9 per cent. at the outside. On the other hand, the cost of all equipment is less now than it was in 1929; copper which was taken at £70 per ton is now only £40 per ton, and money could now be borrowed on a 4 per cent. basis (or less) as compared with 5 per cent. taken in the Weir Report. As the volume of unemployment is still a most pressing problem, and so far as the electrical industry is concerned, is likely to be worse rather than better owing to the completion of the contracts for the Central Electricity Board, there appears to be more justification than ever for pressing forward with a bold policy.

What the Central Board Might Do

The provision of capital by the railways might appear to present some difficulty, but if the Central Board were empowered to supply the railways direct it could be responsible not only for transmission lines and sub-stations, but also for the track equipment, leaving the railways to provide the electrical equipment of rolling stock and electric locomotives, which they would do instead of providing any additional steam locomotives. Under these conditions one can envisage



An interesting comparison of old and new in the Trafalgar Square sub-station of the London Electric Supply Corporation, Ltd. An old Ferranti " 150 h.p." single-phase, 10,500/2,625-V transformer, and modern 1,500-kVA, 6,600/2,625-V, B.E.T. Scott-connected equipment

an arrangement by which the Central Board would sell electrical energy at an inclusive price per kWh delivered to, and metered at, the locomotives and multiple unit stock. A comprehensive scheme will produce assets of definite value for this country.

Heavy-oil Engine Working Costs

THE tenth annual report on heavy-oil engine working costs was discussed at a recent meeting of the DIESEL ENGINE USERS' ASSOCIATION in London.

Cost figures from fifty-four stations are included in the 1931-32 returns, four more than in the preceding year. Several overseas members have commented on reduced output due to the decline in trade. The average results were: cost, 0.521d. per kWh generated; plant capacity per station, 1,040 kW; running plant load factor, 62.7 per cent.; annual plant load factor, 12.9 per cent.; fuel oil, 0.667 lb. per kWh generated; and b.h.p.-hours run per gallon of lubricating oil, 1,990. The most effective influence on cost reduction seems to have been the increase in plant capacity per station during the year.

Engine size has been increased by the inclusion of a two-stroke opposed-piston 2,300-b.h.p. engine made by the English Electric Co., Ltd., and installed by the Bermuda Electric Light, Power & Traction Co., Ltd. It is too early yet to expect much information about the performance of the Davey-Paxman and Ruston & Hornsby supercharged engines at Ashford, but better fuel consumption is already indicated. The aggregate capacity of new engines installed during 1931-32 among the stations from which returns have come in was not quite so large as in the preceding year, having been 4,720 kW as compared with 5,900 kW.

With a rather larger list of stations, the total output on which the results recorded have been obtained is over five million kWh less than for the preceding year, probably due to the low state of trade. The effect was most marked in the overseas stations group. The average annual plant load factor fell by 2.6 per cent. The average running plant load factors of both main groups also declined, but, notwithstanding the less favourable running conditions, average fuel consumptions were slightly better than last year, and there was also a very considerable improvement in economy of lubricating oil consumption. Also, the average price paid for fuel fell several shillings per ton, and under one section of costs of the nature of standing charges there was a tangible reduction in the repairs and maintenance cost per kWh. Altogether there was an improvement of 8.3 per cent. in engine cost per kWh generated in the home stations group and of 8.6 per cent. in the overseas stations group.

Improvement in engine design, particularly with regard to rendering maintenance work more efficient and easy of execution and to the reduction in the rate of wear of running parts by superior application of lubrication, has advanced rapidly during recent years.

Fuel Consumption and Thermal Efficiency

Calculated on the basis of a gross calorific value of 19,500 B.th.u. per lb. of fuel, the overall thermal efficiency with an average fuel consumption per kWh generated of 0.687 lb. was approximately 25.5 per cent., the running plant load factor having been 63.5 per cent. The corresponding figures for the preceding year were: thermal efficiency, 25.4 per cent., and running plant load factor, 66 per cent., so that there has been an improvement under this heading. Some of the best fuel consumption results were extraordinarily good in respect of each of the main types of engines; some of them were as good as original test-bed results. This is not a reason for doubting their authenticity, as it is well known that heavy-oil engines, properly handled, will maintain results equal to their original best performance for very long periods, and sometimes improve on the original test results.

Some Line Insulator Criteria

AT the monthly meeting of the OVERHEAD LINES ASSOCIATION in London on December 21st Mr. R. C. Andersen read a paper entitled "Some Line Insulator Criteria." The author said that the clauses inserted in insulator specifications with the object of obtaining sound porcelain varied so remarkably that one was forced to the conclusion that this particular branch of the subject might with advantage be more closely studied.

Porosity and puncture tests afforded but a poor indication of the relative value of insulator body. For the proper determination of sound electrical porcelain no procedure was so efficacious as the normal routine time-puncture flash-over test carried out in sequence with the high-frequency "kick" test.

Under extreme thermal stress conditions, the mechanical strengths of all standard porcelain bodies might be accepted as approximately equivalent. Sudden temperature changes varying in value up to 100 deg. C. were relatively common within line insulators, and it was arguable that their effect, continually imposed, would be as effective in breaking down its molecular structure, unless the latter was safeguarded, as single temperature test cycles. Accepting this assumption, then cracking was much more likely to occur because of poor cement and metal assembly than because of porcelain toughness varying. For high voltage steatite, melalith, and similar non-porcelain products, pending further investigation and development, were questionable on the score of efficiency.

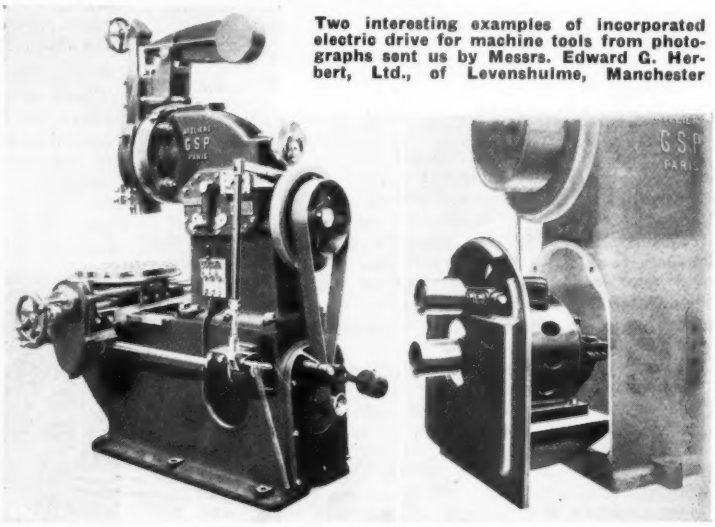
Were the orthodox insulator shapes correct for the service conditions with which they must contend? The standard insulator string had much to be said for it. Furthermore, the units were ideal for mass production and, therefore, most economic to install. Most suspension insulator trouble could be traced to pre-determined under-insulation associated with questionable tower design. Again, 90 per cent. of insulator failures were a direct result of faulty assembly of porcelain, metal, and cement.

A 5 per cent. cracking rate commencing in four or five years was by no means uncommon, but with refined assemblies it was safe to carry through computations on a 1 per cent. basis or, at the most, 2 per cent.

Members' Views

Major T. Rich spoke of the disadvantage of supplying insulators to meet exaggerated tests rather than the actual practical conditions. Mr. J. F. Shipley referred to his experiences in Nigeria, where there was lightning for six hours a day for six months in the year. On two overhead lines breakdowns and interruptions due to broken insulators were such that he dared not report them, but eventually by earthing the line at every ten poles instead of only at the two ends, using lightning arrestors in special places, insulating the neutral instead of earthing it, and using "non-puncture" insulators, the number of interruptions had been reduced to three, with only forty-five minutes' stoppage with two cracked insulators in one case, and no broken insulators in the other.

Mr. Harris said that too often the unfortunate insulator maker was told that the cost of insulators was extremely important, notwithstanding that it was such a small percentage of the total cost of an installation. Contrary to the author, he believed the puncture test had a very definite value in the sequence of tests now regarded as normal. Appealing for a national standard specification, he said it should only be regarded as a framework upon which to build special specifications to meet particular local conditions. Mr. J. H. C. Brooking pointed out that no mention had been made of the improved type of insulator put forward by Mr. Ryle in his recent paper as the result of long experience on the North-



Two interesting examples of incorporated electric drive for machine tools from photographs sent us by Messrs. Edward G. Herbert, Ltd., of Levenshulme, Manchester

East Coast. Mr. W. J. Johns commented on the need for some method of ascertaining accurately the electrostatic field round an insulator. Mr. R. B. Matthews suggested that line insulators might be graded.

Mr. F. Nuttall, in a written communication, referred to the work of the High Tension Conference and the need for practical information with regard to surface leakages. The Hon. Secretary (Mr. H. Molle) asked for information of operating experiences to be sent to him.

Helping the Manufacturers

The President agreed that it would not be possible to draw up a specification for an insulator that could be expected to be successful under all climatic conditions. His own practice was to adopt the experience of reputable makers and then to acquaint them from time to time of the practical results so that improvements could be embodied in future designs. Many questions of design could only be answered by observation and the careful collection of data, and it was the duty of the operating engineer to do this.

Mr. Andersen, in the course of a lengthy reply, said that insulators depreciated very badly if left in store for any length of time when they were made under the conditions which gave high puncture test results. Electrostatic stressing was one of the prime causes of insulator failure, because it gave rise to deposits that created leakage currents which set up heat and so increased thermal stresses. Thus there was a complete cycle tending to break down the insulator. Those responsible for a national specification fully realised that it would be too complicated a document if any attempt were made to render it of universal adoption. At the same time, a national specification could be made to fulfil the most important functions, and then the operating engineer, with his experience, could take what he wanted out of it and add clauses to deal with his special local conditions.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Inadequate Mains—Indifferent Employés

The letter from "An Indifferent Employé" in your current issue reveals a youth who entered the electricity supply industry without any training (from a boarding school, as he says) and immediately starts to throw his weight about. No wonder after ten years he complains of brickbats, has reached the position of sub-station attendant, and signs himself "An Indifferent Employé."

In 1898 I was one of three young men who after a training in theory and the "shops" held the job of switchboard attendant in the electricity department of a well-known corporation. Our "salary" was 15s. a week for a week consisting of fifty-six hours, or *nearly* 3½d. per hour! Although the plant and output were small in those days yet the excitement in keeping the supply going was great. Unlike the present-day spoiled and pampered youth we had no time to criticise and be disloyal to those placed in authority over us or groan about our conditions.

Even to-day the young man with "guts," brains, and a proper training can get on well in the electricity supply industry providing he is also a decent fellow and loyal.

M.I.E.E.

December 23rd.

Blade Erosion

In reference to Mr. F. J. Taylor's article on this subject in your issue of December 23rd, I should like to correct two mis-statements which occur in the penultimate paragraph. From the wording of the last line of this paragraph it could be understood that more than four blades had not been used in a Kaplan turbine. This is totally incorrect, as the four units at Schworstadt are fitted with five blades, capacity 40,000 h.p., head 38 ft., and the new Shannon unit is fitted with seven blades, capacity 40,000 h.p., maximum head 102 ft.

Secondly, Mr. Taylor speaks of the length of the blades not exceeding the pitch; presumably by this he means circumferential length more usually referred to as the width. In no case does the blade length exceed the pitch, in fact, it is a characteristic of the Kaplan turbine that when the blades are horizontal and the turbine is viewed from above there is invariably a clear space between two neighbouring blades, that is to say the circumferential length is always less than the pitch.

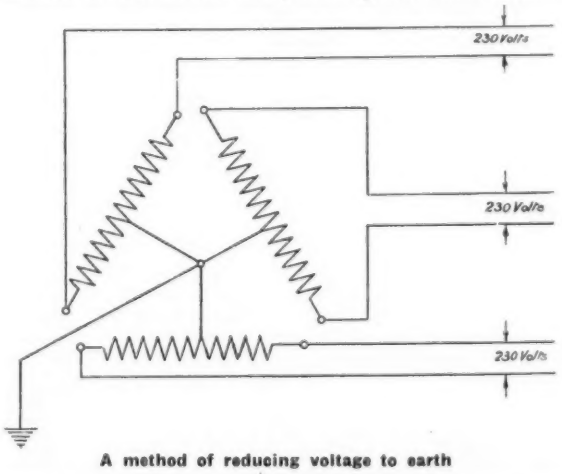
H. H. SIEVEKING, A.M.I.E.E.

London, N.W.3, *December 23rd.*

Reducing Voltage to Earth

The modern practice of changing over d.c. l.v. systems to a.c. for domestic use has necessitated the employment of special methods to avoid shock to earth, but in spite of all the excellent devices and material now provided, accidents do occur, and when they are fatal the report of the subsequent proceedings increases the doubt already in the mind of the man-in-the-street as to the safety of electricity, and of the advisability of allowing it to be used in his house.

The safety factor could be substantially increased by reducing the danger itself to reasonable dimensions—by halving the voltage of any conductor to earth entering a house, but energising equally all conductors, so as to make possible the use of the existing 230-V equipment—and at the same time to keep down as far as possible the cost and size of the cables.



A method of reducing voltage to earth

The connections of the ordinary commercial transformer stepping down to 400/230 V could readily be altered from the usual l.v. star arrangement, giving 230 V to earth, to those shown in the sketch, which shows the alterations necessary to reduce the voltage of any terminal to earth by half. The cables from the transformer with the phase mid-point at earth potential are shown run in pairs with a phase voltage of 230. Were domestic apparatus supplied from transformers connected as shown, or any other arrangement to give half the usual voltage to earth, danger from shock to earth would be practically eliminated; this seems a better proposition than the present-day obviously unreliable methods of earthing.

Alternatively, a transformer giving only 230 V between phases with the star point earthed, would give nearly the same safety; only the three phases would be used, and three conductors required. It is appreciated that this arrangement of supply could not be generally adopted owing to the additional cost and complications; on the other hand there are places where the voltage on the conductors could be conveniently equalised, and thus remove the present guarded, but ever lurking, danger of shock to earth.

W. A. JOYNSON.

Leigh, Lancs, *December 16th.*

The new "Revo" lighting at Hyde Park Corner, with the Royal Artillery Memorial in the foreground (see page 973)

Remote Control

In the December 9th issue of the ELECTRICAL REVIEW (p. 842) there was a paragraph relating to the subject of remote control of power equipment as applied to the new signalling installation on the Stanmore extension of the Metropolitan Railway. In this the writer implies that the question of remote supervisory control has not been effectively tackled by engineers responsible for switchgear, transformer and convertor operation on extensive power schemes such as the grid.

It may, therefore, be of interest to you to know that we have for some considerable time past designed, manufactured and supplied such equipment for installation in Argentina, New Zealand, India, &c. We were also favoured with the contract for the complete equipment of supervisory control for the Central Scotland area of the grid scheme now coming into operation, and are now working on similar equipment for the North-West England and South-West England areas.

AUTOMATIC ELECTRIC CO., LTD.

Liverpool, *December 21st.*

Our Jubilee

Allow me to offer my most sincere congratulations to the ELECTRICAL REVIEW on its sixtieth birthday—I purchased No. 1 in Southampton, and recollect the interest all of us in Mr. (later Sir) W. H. Preece's office took in it. Since that date I have never missed a number.

Having come to Brazil in 1876, at the instance of the Cia Paulista Railway, your REVIEW has been of the greatest assistance during all these years in keeping me up to date in what is happening in the electrical world.

I trust that you will continue with the same good work for many years to come. R. G. B. DAVIDS, M.I.E.E.

Sao Paulo, Brazil, *December 5th.*

The Patents Position

We were much interested to read Mr. G. Watson's letter in last week's ELECTRICAL REVIEW regarding the above, and would endorse the last paragraph, *viz.*, "the damage done to progress in this country by the present patent loss is incalculable."

At the present time we have a dozen articles we could and would patent if the costs were not so great. If we patent the whole twelve, the result obtained from the one or two that may be successful would be more than swallowed up by the costs. There is also another feature which to our mind is very unfair, the fact that there is one common fee, quite irrespective of the number of articles made, and a firm that turns out 100,000 articles in, say, the eleventh year of the patent, pays £12 for renewal. The same applies to a firm which only makes perhaps twelve articles, which would thus cost £1 each for patent fees.

Surely a proportional charge, say one per cent. on the selling price, would be much more equitable!

THE CURTIS MANUFACTURING CO., LTD.
J. C. Curtis, *Managing Director.*

London, W.C.2, *December 24th.*

House Wiring Needs Simplification

AT the informal meeting of the Institution of Electrical Engineers in London last week, Mr. F. C. Raphael opened a discussion on "House Wiring Simplification and Elaboration." He said that a definite stride in the direction of simplification had recently been realised by a process of elaboration: an Advisory Council of the Building Industry had been formed, whose aims were (*a*) to reduce the mass of legislative control which was burdening and retarding building construction and technique, and (*b*) to ensure that the necessary degree of co-ordinated control in the form of basic regulations with respect to the newer equipment and practices of the industry was such that it would not create those same disadvantages to which the old forms of building construction and equipment had been subjected.

The constitution of this Advisory Council included representatives of most of the technical societies. It was divided up into "panels," and the Electrical Equipment Panel appeared to be among the most active. It did not want to reduce legislative control, but had adopted the idea of "the necessary degree of co-ordinated control in the form of basic regulations" whole-heartedly, doubtless considering that electrical equipment was one of the "newer equipments and practices" of the building industry. The chairman of this panel appointed to produce these basic regulations was the chairman of the I.E.E. Wiring Regulations Committee, so that the elaboration of having an electrical panel of the Advisory Council was, in effect, a simplification. These basic regulations would be, of course, the I.E.E. Regulations.

But elaboration was not entirely eliminated. The panel recommended that the I.E.E. Regulations should be so coded as to be of *standard* application to *all* buildings, and that there should be, in addition, special regulations for a large number of buildings divided into two categories which were to be further classified from time to time by usage.

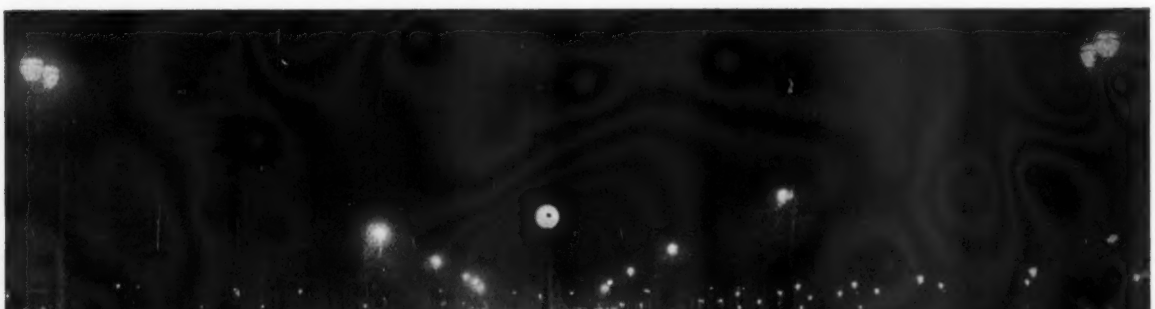
The Best Contractors' Practice

Mr. Raphael said that in first-class wiring practice, as carried out by those firms to whom the I.E.E. Regulations represented no more than a confirmation of their own ideals, they were occasionally handicapped by adverse conditions and, especially in recent years, one of the chief handicaps had been damp or wet conduit runs. Having been brought up for years with the cable-makers' specification "tested after twenty-four hours' immersion in water" under his nose, the contractor did not like to consider it possible that india-rubber was not waterproof. He thought that if faults arose due to damp in conduit he must have damaged the india-rubber of the cables in drawing them in, and he considered that it was only necessary to prevent really serious accumulation of water in his conduit system. Screwed conduit was erected nowadays in such a manner that low end-to-end electrical resistance was deemed more important than waterproof joints, the conduit system could not be waterproof, and a very large proportion of the moisture in the conduit which was ascribed to condensation was due to direct influx of water through the joints in the conduit system.

Waterproof Installations

If, therefore, they were to continue to carry out first-class sunk work it must be a first condition that the whole of the system be waterproof and, since one could not avoid some condensation, the insulation of the cable must also be waterproof. If rust affected the insulation of the cable, either the conduit must be rustless, or the cable must be rustproof. He was still waiting for somebody to introduce a waterproof metallic packing with which to surround threads. An alternative method to red lead and tow joints was to paint all joints outside with some waterproof composition. But this might not always prove satisfactory under ordinary building conditions.

Lead-covered cable was waterproof and so was c.t.s. cable. Lead-covered cable was rustproof, but one had never been able to obtain a guarantee that c.t.s. sheathing would withstand rust. Both these cables, however, involved an increase in diameter, which entailed the use of larger size conduit, and this solution must, except in particular cases, be abandoned for economic reasons. Several cable-makers had drawn attention to special rustproof cables which, it was claimed, were also waterproof. Unfortunately, except in the case of one, the increased diameter was a bar. Peculiarly enough, there was no specification whatsoever as to the thickness and quality of the internal enamelling of conduit. Neither could one feel entirely confident that sherardised or galvanised conduit would not rust in the continued presence of moisture.



A further improvement in London's lighting: A view of the Mall, looking towards Buckingham Palace, taken by the light from fittings recently supplied by the General Electric Co., Ltd. Twin ornamental lanterns equipped with 1,250-W lamps are employed throughout the scheme

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Three " Lektrik " Switches

MESSRS. A. P. ANDBERG & SONS, LTD., 477-489, Liverpool Road, N.7, have sent us samples of their latest lines.

The " Speedy " double-pole switch-in-line, rated at 10 A at 250 V, is finished in black moulded " Bakelite," the operating lever being marked " on " and " off " in white. The switch measures 3 in. by 1 7/8 in. by 1¼ in., and it is available with an earth wire connection at 57s. per doz, or without at 54s.

The " Speedy " and " V.C.S." switches

The other new " Lektrik " switch is the " V.C.S.," a small 3 A, 250 V pattern which can be used in vacuum cleaners, radio sets, &c. It incorporates a single-way q.m. and b. movement with a snap action, and is compact in size, measuring only 1¾ in. by ¾ in. by 1 in. The " on " position is marked by a white line on the black " Bakelite " operating lever. The fixing holes in the rust-proof steel frame are threaded for 5 B.A. screws in the " Standard " pattern, and in the " Extended " type have a 1/32 in. clearance. Both types are priced at 17s. per dozen.

Safety Adaptors

In our September 16th issue we referred to the M.K. rectangular fuse plug which was then a new development. The same design of plug and fuses has now been incorporated in a new two-way plug adaptor which is made for plugging direct into a 15-A socket.

The new M.K. safety adaptor

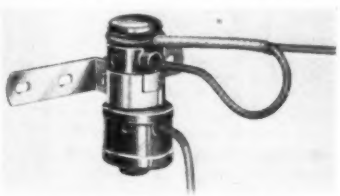
This new adaptor, made by the M.K. ELECTRIC, LTD., Wakefield Street, Edmonton, N.18, has a main 15-A outlet and also a 5-A outlet which is protected by a d.p. cartridge fuse, rated at 1, 2, or 5 A. The two-pin adaptor is priced at 36s. per doz. and the three-pin model at 50s. per doz.

We are also informed that the range of " slot " switches and 5-8-A tumbler switches has been reduced in price.

Rewirable Outdoor Cut-outs

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, have recently introduced a rewirable outdoor insulated service cut-out for overhead distribution systems.

This addition to the " Isco " range is rated at 30 A, 250 V, and will accommodate service wires up to 7/32 in. in diameter, and it is suitable for mounting on the wall of a consumer's premises or on the line pole.



The " Isco " outdoor cut-out

Porcelain is used for all insulating parts, and exposed surfaces are glazed in green, thus rendering them less conspicuous. All current-carrying parts are made of heavily tinned brass.

The fuse cartridge can be withdrawn from the carrier on site for rewiring by means of the specially designed extractor: this extractor can be mounted on a wooden pole of sufficient length to permit the withdrawal when the operator is at ground level. The fuse chamber is so constructed that when the fuse blows the volatilised metal is ejected downwards clear of the fuse wire screws.

The method of re-wiring is as follows:—The plug screw at the top of the cartridge is removed and then the fuse wire is threaded through the lower hole in the cartridge below the clamping screw and up through the interior of the cartridge. The end of the fuse wire is formed into a small loop, which is placed in the hole provided for the plug screw and clamped down by tightening the plug screw in position. The other end of the fuse wire is then twisted round the dished washer above the lower hole and the clamping screw tightened up.

The complete outdoor " Isco " with light bracket drilled for two fixing screws or bolts is priced at 4s. 2d., or with a heavier bracket drilled with four fixing holes, 4s. 6d. Spare cartridges (unwired) are available in standard packets of ten for 12s. 6d. per packet, and metal extractor tops for the operating poles for 10s. per packet of ten.

Local Thermal Storage Heaters

One of the latest developments in local thermal storage space-heating equipment is the " No. 170 " Soapstone radiator priced at £6 12s. It has been designed according to the specification of the Fire Office Committee for use in public wharves and warehouses. The SOAPSTONE PRODUCTS CO., 6, Holborn Viaduct, E.C.1, the makers of this radiator, tell us that the " charging " period is about seven hours, the heat being retained for about eight hours after switching off.

The Soapstone " No. 170 " radiator

The windings are arranged in series-parallel so that by means of a three-heat switch loadings of 1,500, 750 or 375 W may be used; this switch is mounted in an ironclad case with a d.p. switch and fuses and a pilot lamp. The dimensions of the radiator are 22 in. high by 8¼ in. deep by 14 in. long, and its weight is about 130 lb.

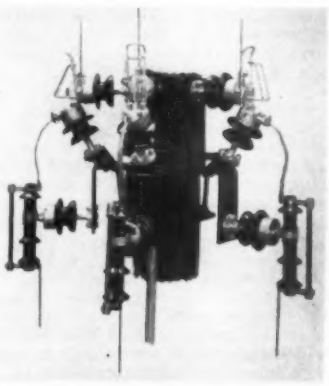
The Welding of Dental Plates

The introduction of stainless steel as a substitute for gold or platinum for the manufacture of dental plates has led to some very interesting problems. The only possible method of joining the parts of these plates is by welding, and unless the weld is made correctly the material becomes brittle; it has been found that to be successful the joint must be made on a rising temperature curve.

MESSRS. MARRYAT & PLACE, 40, Hatton Garden, E.C.1, have introduced an ingenious automatic machine to effect this purpose. The parts to be welded are placed between electrodes of a special welder so arranged that the current is cut off at the critical moment. For attaching the steel wire posts of the plate, a special attachment of the scissors type is supplied in which the plate is clamped in one arm of the scissors and acts as one electrode against which the post is pressed by the corresponding electrode fixed in the opposite scissors arm.

E.H.P. Switchgear

MESSRS. DRAKE & GORHAM, LTD., Park Royal Road, North Acton, N.W.10, have produced an entirely new design of switch which can be fixed to any size or shape of pole without drilling or slotting, the time for erection on site being reduced to a matter of minutes. The operating rod lies snugly against the pole and does not interfere with the fixing of a transformer underneath the switch. Fuses can be fitted if required. The switch is particularly useful when a tapping has to be taken off an existing live line, as the switch can be clamped in position and operating gear fitted whilst the line is alive, leaving only three short leads to connect when the line is made dead.



An 11-kV, t.p. switch fitted with fuses for small circuits

The base of the switch consists of a bent steel plate presenting three flat surfaces, the three surfaces embracing a little over half the circumference of the pole. This base is clamped at the top and bottom by means of a heavy rectangular linked chain with means of producing the necessary clamping pressure. The three surfaces each have a piece bent outwards horizontally to carry the moving contact pivot bearing.

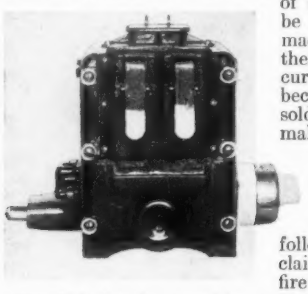
Each pole has a fixed and moving insulator. An ingenious

coupling with swinging links transmits the moving force from the operating rod equally to each moving insulator with its knife blade and arcing horn which ensures that each pole is broken simultaneously. Double arcing horns are used throughout. A short flexible tail is used for connecting to the fuses or transformer terminals.

The mechanism has a 180-deg. throw, ensuring that the switch cannot be slammed in at the end of the travel, thus avoiding insulator breakages. Any standardised type of fuse can be fitted by arrangement.

Electric Brazing

For overcoming the difficulty experienced in making satisfactory joints in fine copper wires, BRITISH INSULATED CABLES, LTD., Prescot, Lancs, have produced a small machine which is an adaptation of a B.I. welder, but the material, instead of being heated to welding temperature, is heated by the current sufficiently to melt the brazing metal, which usually consists of silver solder. The wires to be brazed are clamped in the machine in the usual way with their ends abutting; when the current is switched on the wire becomes hot, melts the silver solder, and simultaneously makes a sound joint. The machine is 9 in. high, 11 in. wide, and 8½ in. deep, and is loaded at 500 W.



The B.I. brazing machine

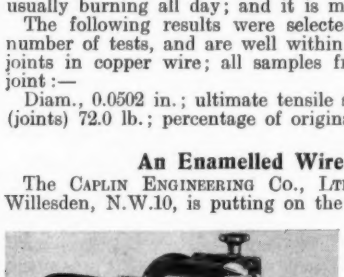
As compared with joints brazed in a gas flame the following advantages are claimed: The elimination of fire risks to either operator or property; purer atmosphere for operators to work in; heat under better control; the operator can see clearly what is happening; the joint cannot be brazed unless ends of wire are in contact with each other; it is cheaper, as electricity is not being used except when the machine is in use, whereas gas flames are usually burning all day; and it is more portable.

The following results were selected as typical of a large number of tests, and are well within the limits allowable for joints in copper wire; all samples fractured away from the joint:—

Diam., 0.0502 in.; ultimate tensile strength (plain) 75.0 lb., (joints) 72.0 lb.; percentage of original wire, 96.0.

An Enamelled Wire Cleaner

The CAPLIN ENGINEERING CO., LTD., Beaconsfield Road, Willesden, N.W.10, is putting on the market a new cleaning machine for enamelled wire costing about £35.



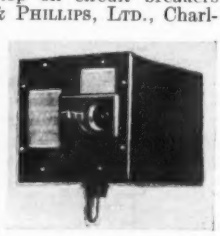
The "Capco" wire cleaner

This "Capco" machine enables wire to be cleaned for soldering and avoids ragged ends; skilled labour is not necessary to work it. An adjustment enables any size of wire to be cleaned. Dust is exhausted by an electric fan, and is deposited in a detachable bag at the rear of the machine. Two totally enclosed motors rated at ¼ h.p. provide the power to drive the fan and the two revolving brushes which clean the wire.

An Auto-reclose Device

The J. & P. auto-reclose device has been designed to provide a simple and reliable mechanism for the automatic reclosing of the type E.K.C. pole top oil circuit breakers manufactured by MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, S.E.7.

The mechanism is fitted in a sheet steel box, which takes the place of the usual operating handle situated near the foot of the pole. It is wound up by hand and can be set by the attendant for one, two, or three reclosings, and it is not necessary to wait until all three closing operations have been completed before re-winding.



The J.P. auto-reclose device

No low voltage supply motors or other electrical devices are necessary, the entire reclosing gear being mechanical. The necessary energy for reclosing the breaker is stored in a powerful scroll spring, which operates at a very high factor of safety, and is enclosed in a dust-tight case. A crank at the rear of the case transmits the motion by means of a connecting rod to the circuit breakers, the resetting stroke being retarded by an adjustable oil dash pot in order to give the required time delay between the tripping of the breaker and its reclosing; the usual time lag recommended is about thirty seconds. The dash pot is immersed in the oil tank of the circuit breaker, and there is consequently no danger of its losing its oil.

When the breaker trips electrically the action of the switch opening releases the auto-reclose mechanism, and this immediately commences the retarded resetting stroke, which is followed by the rapid closing stroke. Should the short-circuit still exist, the breaker again trips out and is once again reclosed, but, if after the third reclosing the breaker still trips out, it is automatically locked out, and must be reset by hand after the cause of the fault has been removed.

The switch can be opened at any time by means of the lever on the underside of the case, and it is fitted with a device which makes it impossible to open circuit slowly. By moving the lever to the left the breaker is closed. Means are provided for locking this lever in the "on" and "off" positions, and there is a clear indicator in the front of the case showing for how many reclosings the mechanism is set, the pointer also indicating when the breaker is "off."

Combined Spot and Inspection Lamp

A new "Marelli" combined spotlight and inspection lamp has recently been put on the market by MESSRS. FEENY & JOHNSON, LTD., 134-136, Ealing Road, Wembley. The lamp, which has combined with it a driving mirror, is provided with a universal bracket so that it can be readily attached to the front of a car. Two lengths of cable are provided, a short one for use with the spotlight, and a long one intended to be employed when the appliance is used as an inspection lamp. The spare long cable is carried in a neat metal case. The outfit is made for either 6 or 12 V circuits, and is priced at £2 2s.

The "Marelli" inspection lamp

A Spade for Cable Laying

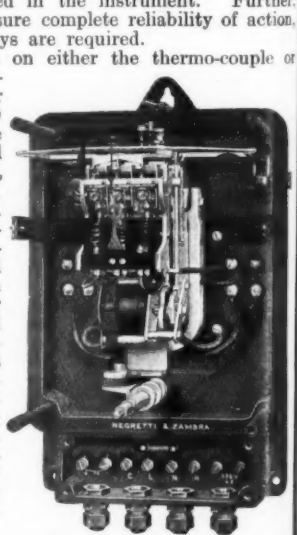
MESSRS. "ADAMSAID," Bentinck Street Works, Ashton-under-Lyne, inform us that they are marketing a new spade known as the "Easydig." It is claimed that it penetrates the soil as easily as a fork, but lifts like a spade, and is particularly useful for wet or sticky soils. Seven-inch spades cost 7s., with a "T" handle; "D" handles cost 9d. extra, and 8-in. models 6d. extra.

A Pyrometer Controller

A special feature of the pyrometer controller recently introduced by MESSRS. NEGRETTI & ZAMBRA, 38, Holborn Viaduct, E.C.1, is that no work is performed by the thermometer mechanism, because all the contacts are operated by a synchronous motor incorporated in the instrument. Further, mercury-switch contacts ensure complete reliability of action, and in many cases no relays are required.

The instrument operates on either the thermo-couple or electrical resistance principles, and is suitable for temperatures up to 1,400 deg.C. It is available in three models with one, two and three switches, respectively, 15 A for one switch and 5 A for two and three switches.

The temperature movement is of the spring-controlled moving-coil type, and the scale length is 5¾ in. In the thermo-couple controller the movement is provided with an automatic cold junction compensation to correct for air temperature variations, while with the electrical resistance controller an "all-mains" unit is supplied which enables the instrument to operate directly off the a.c. supply. A setting pointer can be adjusted externally to any position.



Three-switch "Negretti and Zambra" pyrometer controller

In the instrument illustrated there are three pallets connected to the three switches. The central pallet represents the correct temperature, and the slightest deviation causes either the "high" or "low" lamps to light. A depressor bar which actuates the control gear drops for a period of ten seconds every twenty seconds, and, through a flexing pointer, depresses whichever pallet it is over at the time. Although the cycle of operations is completed every twenty seconds, any switch remains in the same position for any multiple of twenty seconds, until the change of temperature is of such a magnitude that an alteration in its position becomes necessary.

Modern Production Costs. By Frank Wild, Assoc.I.E.E.

Finished components and their relation to stock control

MODERN demands for the quick delivery of finished products allied with a request for a reasonably low-priced article have, of recent years, revolutionised methods of workshop production and the control of stock. These two features are inseparably linked together and form the main fabric of modern manufacturing methods. It follows, therefore, that extreme care and consideration must be exercised in the manipulation of an efficient system of stock control, together with economical means of production. Before attempting to give particulars relating to actual production it will be advantageous to consider the factors which lead up to and promote the necessity for commencing manufacture.

The orthodox manner of securing contracts and the order of production processes follows a sequence similar to the following:—(A) Prospective customers intimate, usually by enquiry, that they are contemplating placing a contract for a particular article or possibly certain electrical plant; (B) sales organisations of manufacturers commence to solicit further details and begin to negotiate; (C) estimating, or precost, departments price enquiry; (D) order received and production machinery commences. A period of time, varying probably from a few days' to two months' duration, is taken up between (A) and (D), which is very often of vital importance in relation to the time allowed for the execution of the contract. In many cases by the time negotiations have been completed under heading (B) the manufacturer is in possession of sufficient information to judge what prospect there is of securing the contract, the maximum delivery period allowable, how the required article compares with standard designs, and what competition is likely to be met with.

From the foregoing remarks it becomes clear that vital decisions become necessary after deliberations under heading (B) have been completed. Two questions of outstanding importance are: Can delivery be met under normal working conditions? And can production costs be controlled in such a way as to allow a reasonable margin of profit? Due to the repeated demands for short delivery dates steps must be taken to cope with the situation.

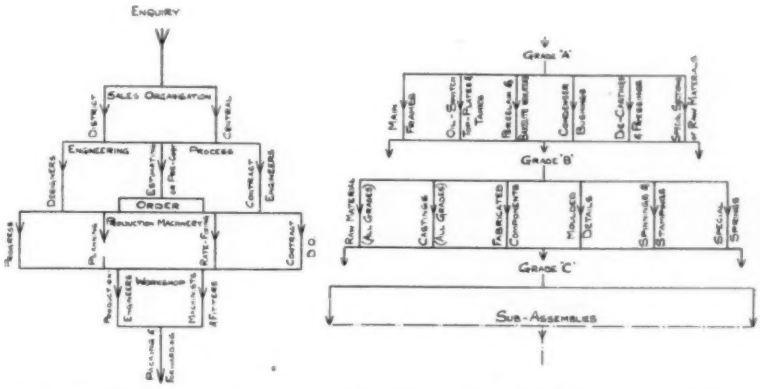
The Employment of Existing Facilities

In the first instance it is necessary to calculate what is the best delivery date which can be guaranteed under normal working conditions. Let us assume that the state of conditions existing is such that only by working excessive overtime and considerable speeding up can the deliveries be met. There will obviously be a case here to make arrangements by means of which the overtime and speeding up can be eliminated to a point consistent with regular efficiency of output. It is not considered good policy to make extensions to the factory, as the volume of business to be dealt with does not warrant the extra outlay which would be incurred. The introduction of new plant would not permit an efficient layout and would not, in consequence, give an adequate return for the capital expenditure involved.

We will assume that the contracts under review are for metal-clad compound-filled switchboards, a class of gear which at the present time is in great demand. Up to date it has been the custom to carry a stock of the primary limiting features of these units. Assuming that the design department has done its work efficiently by making as many component parts as possible common to all types of pillars, has designed them with the object of reducing manufacturing costs to a minimum and has also reduced the number of components to a minimum, it is possible to concentrate upon authorising further stock. In considering the advantages to be gained by putting further components into stock several important factors must be given careful thought. In the first place it is wise to make a summary of the components which have not yet been manufactured upon a stock basis.

The limiting features stocked will probably constitute the following: Main frames, oil switch top-plates and tanks, porcelain and "Bakelite" insulators, condenser bushings, and such auxiliary details as non-ferrous die-castings and pressings, which are often purchased from outside suppliers. The components which now require to be classified, and have been considered as of secondary urgency, would include the following: raw materials for producing all components, castings (machined or unmachined to be decided later), fabricated components, moulded insulation details, such as terminal bases and auxiliary switch parts, and steel spinnings and stampings.

Whenever components are being manufactured upon a stock basis it is possible to plan operations and fixtures to the best advantage. Special tools and attachments can also be considered upon a scientific basis provided an efficient check is kept upon their cost and general usefulness. Multiple fixtures, jigs and press-tools can often be employed with advantage due to the increased number of articles produced in a given time with one set-up. Another issue which is worthy of consideration is the desirability of stocking sub-assemblies, such as contact fingers, bus-bar and current-transformer chambers complete with insulators, oil-switch mechanisms, &c. Very often a considerable saving can be effected by assembling these items in reasonable batches instead of issuing orders for only one or two as required against customers' orders.



Left: Progress from enquiry to completion. Right: Priority of raw material, components and sub-assemblies with regard to stock (metal-clad pillars)

A very considerable responsibility rests upon the designer of the apparatus. Ease of assembly, simplification of layout, and free access for replacement and adjustment are only a few of the many points which must be very carefully thought out before putting a new design into full production. Therefore ample time should be allocated to the designers. Very often a little extra labour spent in the drawing office can be profitably employed in saving labour in the workshops. On standard designs this saving of labour is, of course, a recurring factor.

The Progress Department

Owing to the fact that we are considering output with regard to stock control, it is essential that the progress staff should pay particular attention to the position of stock orders in the factory. As the demand increases and also as the delivery dates become more and more bargaining points so, in a similar proportion, does concentration upon the completion of stock orders become necessary. The present tendency in connection with the relationship between supply and demand would seem to indicate the desirability of maintaining special gangs of workmen employed solely upon stock order work. This arrangement helps towards the manufacture of gear of uniform quality and the cheapening of labour by dexterity of workmen in handling similar products regularly (this process should be reviewed periodically), while it can also be used as a means for discovering more efficient and cheaper methods of manufacture.

There is a strong argument in favour of deciding to set the production machinery in progress as soon as the negotiations under heading (B) are completed when the contract under review is for standard apparatus and quick delivery. There are many side issues associated with such a decision, but usually if the gear in question is a line with a good future the risk attached to such a venture can be justified. If a decision in favour is made by the management, the work issued to the workshops should preferably be restricted to detail work and minor sub-assemblies only.

Ships' Regulations in Italy

The draft of a new series of regulations regarding electric lighting and power installations on board ships has lately been drawn up by the Comitate Elettrotechnico Italiano and is now under consideration. The draft is very complete and sets out not only the types of equipment that may be installed, but also provides rules for their safe working and control.

New Books

Induction Motor Practice. By R. E. HOPKINS. Pp. vii+367. London: Sir Isaac Pitman and Sons. Price 15s. net.

The scope of this book and the method of treatment are unique, and for a subject such as the induction motor an unusual treatment may be regarded as an achievement. The work is addressed not so much to students as to designers and manufacturers. It illustrates how standardisation is necessary to meet competition, though at times modifications are required to meet special conditions.

The first part is devoted to a description of the multifarious requirements of the induction-motor user, and the methods employed to whittle down this vast array into the compass of the standard range of machines. This section contains a number of half-tone illustrations that might well have been omitted. The text, however, is concise. Then comes the section on design and manufacture, from the calculation to the finished machine. The matter descriptive of the stampings, windings, insulation, mechanical details, and testing is excellently done. In the chapter on electrical calculations the author rather regards a number of rules and practical constants, supported by common sense, as the principal equipment for the electrical design of the standard range. And this is probably true.

Over a hundred specimen design sheets are devoted to the standard range—a number large enough to be confusing and to make errors almost unavoidable. Apart from minor criticisms, however, the book can be strongly recommended.

The B.B.C. Year Book, 1933. Pp. 480; illustrated. London: The British Broadcasting Corporation.

To this issue Lord Allen of Hurtwood contributes a chapter on the B.B.C.'s constitution and another section on advertising by wireless is written by Sir Charles Higham, who is entirely opposed to any type of sponsored programme. Mr. Filson Young, in his contribution, says "all broadcasting is advertising in the highest sense of the word." There is a mass of information regarding Broadcasting House, the transmitting plants, and broadcasting in general.

The Elements of Switchgear Design. By DR. KESSELRING, translated by S. R. Mellonie and J. Solomon. Pp. 182; figs. 81. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d.

This book deals with the fundamental physical principles which must underlie the design of any type of switch from a tumbler switch to an oil circuit breaker having a breaking capacity of several million kVA. It covers switching phenonema, the design of conductor systems, flashover and puncture, switch rating, the kinematics of switchgear, and the design of auxiliary apparatus. A useful table of physical constants of conductors and insulators is also given.

The translators point out that the book reflects Continental ideas, and the first chapter provides an illustration of the worst aspects of the analytical methods of which Continental engineers are so fond. In many cases the analytical method is extremely valuable and an endeavour should always be made to express everything in the form of equations, but the method should not be carried to an extreme, especially in a small textbook. The above criticism applies only to the first chapter, as the remainder of the book does not suffer from an excess of analysis, but it is felt that in a few cases, the translators could have assisted the progress of the reader by using more appropriate words in the text, and by providing a list of symbols used in the formulæ. Heaviside's system of units is used throughout, which is very convenient in theoretical work.

The chapter on switch rating is of especial interest at the present time, and a clear account is given of the dissipation of energy in an oil switch during the opening period. The author's researches, made with an experimental switch, are used to illustrate the theoretical discussion. In this connection a bibliography of recent work would have been helpful as the author's original work has recently been extended. On the whole, the book contains much information and many formulæ which should be of use to designers of all classes of switchgear.

"Practical Physics." By W. R. BOWER and J. SATTERLY. Pp. 492; figs. 275. London: University Tutorial Press, Ltd. Price 7s. 6d.

This is the third edition of a book for the use of the upper forms of schools and for technical colleges. Over three hundred experiments are described, covering mechanics, heat, sound, light, magnetism and electricity. In most cases the experiment is illustrated with a diagram or picture, and the theory is given as fully as the space will allow. Frequent cross references are given so that the student can follow up any particular line even when it crosses the boundaries of that section of the ground. The work can be thoroughly recommended; it covers the experimental work of a comprehensive course in physics, and describes all the necessary laboratory apparatus. Furthermore, for those whose facilities are limited, it schedules a number of experiments requiring only the simplest of gear, and many of these could be performed by a reasonably good student without further assistance. The only criticisms from the electrical engineering point of view are of the symbols (C for current, F for capacitance, S for resistivity, &c.), and also of the meagreness of the section on photometry, in which several of the definitions, *e.g.*, luminosity and illumination, need revising.

* * *

Shorter Notices

"Manual of Electricity Undertaking." Pp. 2016. London: The Electrical Press. Price 35s. A new edition revised and corrected to September, 1932, is now available. It records an increase during the past year of approximately 38 million pounds invested in all branches of the British electrical industry, the total investment in which now amounts to 1,058 million pounds. Particulars of dividends, and interest paid by companies are available in the case of 559 concerns, and on an aggregate capital of over 514 million pounds the average over-all return is calculated at 5.72 per cent. All the usual useful sections, brought up to date, again appear.

"The Empire Problem," by D. B. Blacklock. Pp. 100. London: Hodder & Stoughton. Price 3s. 6d. This book is not primarily on electrical subjects, but the chapters on water supply make special reference to the scope for electrical pumping, and even electrical purification. Another chapter, entitled "Darkness in the Tropical Village," shows the progress that has been made in lighting in remote areas.

"Il Proiezionista di Film Sononi" ("The Projection of Sound Films"), by E. Costa. Pp. xxiv+442; figs. 242. Milan: Ubrico Hoepli, Galleria De Cristoforis, 59-65. Price 20 lire.

"Atmospheric Electricity," by B. F. G. Schonland. Pp. 100; figs. 25. London: Methuen & Co. Price 2s. 6d.

"Short Wave Wireless Communication," by A. W. Ladner and C. R. Stoner. Pp. 348; figs. 201. London: Chapman and Hall. Price 15s.

Parliamentary Notes

(BY OUR SPECIAL REPORTER)

PARLIAMENT rose on Thursday, December 22nd, for the Christmas recess, and will reassemble on February 7.

L.N.E.R. Electrification

On December 21st Mr. Hutchinson asked the Minister of Transport whether he was prepared to make a grant to the scheme for electrifying the suburban lines from Liverpool Street to the suburbs in the East of London; and if he would give details.

Lieut.-Col. Headlam said that the railway company had informed him that it had schemes of London suburban electrification under consideration and that in the event of the London Passenger Transport Bill becoming law it would be prepared to submit proposals to the Standing Joint Committee of the Transport Board and the Railway Companies which the Bill proposed to set up, but he was not fully aware of the details of the proposals which the company was likely to make. The Minister had no power to make a grant.

Development in Rural Areas

On December 21st Captain Peake asked the Minister of Transport whether he was aware that electrical development in rural areas was being retarded as a result of the decision of the Court of Appeal in the case of the West Midland Joint Electric Authority *v.* Pitt and others; and whether he was prepared to introduce legislation at an early date to deal with the situation that had arisen.

Lieut.-Colonel Headlam said that the decision did not affect the rights of electricity supply undertakers to apply if necessary for consents to wayleaves required for electrical development in rural areas. It required an alteration in the procedure for determining any disputes as to the compensation to be paid for such wayleaves, and the Minister of Transport was aware that fears had been expressed that this alteration might involve certain difficulties. In his view, there had not yet been sufficient experience of the new procedure to indicate whether further legislation would be desirable.

Expenditure Sanctioned by the Commissioners

On December 21st Mr. Macmillan asked what were the figures for the six months since April 1st, 1932, and for each of the last three completed financial years, of capital expenditure sanctioned in respect of the Central Electricity Board.

Mr. Pybus (Minister of Transport) said that the Electricity Commissioners had sanctioned the borrowing by the Central Electricity Board during the period April 1st, 1929, to September 30th, 1932, of the following amounts:—Year to March 31st, 1930, £4,000,000; year to March 31st, 1931, £8,100,000; year to March 31st, 1932, £6,800,000; and six months to September 30th, 1932, £5,000,000.

Mr. Macmillan also asked for similar statistics relating to capital expenditure by local authorities on electricity undertakings.

Mr. Pybus said that the Electricity Commissioners had sanctioned the borrowing by local authority undertakings (including joint electricity authorities and joint boards) during the period April 1st, 1929, to September 30th, 1932, the following amounts:—Year to March 31st, 1930, £17,780,965; year to March 31st, 1931, £16,032,912; year to March 31st, 1932, £14,150,521; and six months to September 30th, 1932, £8,089,317.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources, Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Yarrow & Co.'s Activities

Among work completed by Messrs. Yarrow & Co., Ltd., during 1932 was the twin-screw turbine machinery for the Admiralty for two of H.M. sloops. Designs were supplied for the complete equipment of Yarrow boilers with superheaters and air-heaters for the *Conte di Savoia*, the new Italian liner, as well as for the complete installation of boilers for a new Dutch cruiser. Various boilers were also put into commission in electric power stations. Orders in hand include one for boilers for the South African Iron & Steel Industrial Corporation, Ltd.

Seven New "Ever Ready" Companies

The registration of seven new "Ever Ready" companies, each with a nominal capital of £100, is announced, the directors in each case being Messrs. M. Goodfellow and A. H. Sheppard, both of whom are directors of the Ever Ready Co. (Gt. Britain), Ltd. The titles of the new companies are: Ever Ready Adhesives, Ltd.; Ever Ready Advertising Co., Ltd.; Ever Ready Gramophone & Wireless Co., Ltd.; Ever Ready Household Requisites, Ltd.; Ever Ready Paints, Ltd.; Ever Ready Polishes, Ltd.; and Ever Ready Transport Co., Ltd.

Malayan Imports of Electrical Goods

Imports of electrical goods and apparatus into Malaya during the first half of the current year represented a total value of £155,313, as compared with £330,001 during the corresponding period of 1931.

Danish Imports Restrictions

By a law dated December 5th certain modifications are made in the existing system of import restrictions. Importers will still require to obtain import licences from the Currency Control Office of the Danish National Bank for certain goods, including telephone equipment, electrical instruments, batteries, electrical installation articles, and machines and apparatus for electrical use, lamps, lamp parts and accumulators, complete radio receiving apparatus and valves, and other wireless material. The law will operate throughout 1933.

Roumanian Import Quotas

The *Board of Trade Journal* reports that the Commercial Secretary to H.M. Legation at Bucharest has forwarded particulars of a decision of the Roumanian Council of Ministers to introduce a system of import quotas for any goods the importation of which it may be deemed expedient to restrict. The importation of goods subject to the quota system is only to be permitted under licence, and a High Commission is instituted to control the distribution of the quotas. Among the goods affected are steam turbines, Diesel or semi-Diesel engines, dynamo-electric machines, electrotechnical apparatus, domestic electrical apparatus, telegraph, telephone and radio apparatus, electric cable and wire and lamps. Any goods entering Roumania by January 15th will not be subject to the restrictions.

Toronto Trade Commissioner in England

The Department of Overseas Trade announces that Mr. A. M. Wiseman, M.C., H.M. Trade Commissioner at Toronto, is now in this country on an official visit. Mr. Wiseman will be available at the offices of the Department on January 2nd, 3rd and 4th, and also during the period January 16th-24th for the purpose of interviewing firms interested in the export of United Kingdom goods to the Dominion of Canada. Subsequently he will visit a number of industrial centres in the provinces. Firms desiring interviews with Mr. Wiseman in London or information regarding his arrangements to visit provincial centres should apply to the Comptroller-General of the Department, 35, Old Queen Street, S.W.1, quoting reference 15340/1/32.

An Aid for Lamp Salesmen

The Electric Lamp Manufacturers' Association has sent us a copy of a useful booklet which it has produced for lamp salesmen. It is well illustrated and commences by explaining the difference between good lamps and bad and then goes on to show why E.L.M.A. lamps are good. Methods of testing are dealt with and reference is made to the extensive advertising of the Association and its members as well as to the assistance rendered by the Lighting Service Bureau at Savoy Hill. The booklet should aid the seller of lamps to understand his job better and thus make customers.

Advertisement Correction

The Simplex Electric Co., Ltd., asks us to correct an error which occurred in one of its advertisements in our last issue (Supplement, p. 19). The prices of three of the fires should have been given as follows:—"Iris" 16s. 6d., "Trivet" 26s., and "Imp" 24s. 6d.

German Circle of Engineers

This Circle held the last meeting of its autumn session on December 19th at the Institution of Mechanical Engineers, when a lecture was delivered by Dr. Ing. Willy Sichardt, of Berlin, on "Ground Water Lowering, and Chemical Consolidation of Subsoils as Means to Facilitate Foundation Work." The chairman, Dr. S. J. Davies, referred to the very wide range of subjects dealt with in the lectures arranged by the Circle, which not only provided an excellent exercise in the German language but also brought engineers into direct touch with fields of work other than their own.

London Tramwaymen's Wages

The National Joint Industrial Council for Tramways has decided to recommend the London tramway undertakings to restore from next April the temporary cut of 1s. per week made in tramwaymen's wages last July. The decision is being opposed by the South Metropolitan Tramways Company, the London United Tramways and the Metropolitan Electric Tramways.

Greyhound Track Lighting

The lighting of the recently opened Dens Park Greyhound Racing Stadium, Dundee, has been designed by Holophane, Ltd., and incorporates approximately seventy 500-W heavy-duty prismatic reflector units arranged in a single line at 18ft. centres and attached to steel poles with suitable overhang to a position central with the track. The units have been attached to the posts by means of special glands and are fed from three-pin watertight plugs attached to the extremities of the posts to facilitate rapid removal when the arena is required for other purposes. The reflector units have been designed specially to eliminate glare, and the employment of a prismatic glass reflecting surface ensures an installation which is unaffected by exposure to atmospheric changes. As shown in our illustration, "Holophane" units are also employed to light the spectators' stand as well as the various club rooms, offices, and announcement boards.

"Holophane" lighting at a Dundee greyhound track

The Illumination of Worcester Bridge

The illumination of the reconstructed bridge over the River Severn at Worcester is carried out by specially designed G.E.C. lighting units equipped with "Wembley" refractors and "Osram" lamps. The lighting standards were manufactured by Messrs. Hardy & Padmore, Ltd.

Electrical Development in New Zealand

A statement recently issued by the New Zealand Government Statistician dealing with electrical development throughout the Dominion during the year ended March 31st last shows a substantial increase in the total number of electric ranges, water heaters, and milking-machine motors installed. The following figures are given with the corresponding totals for 1930-31 in parentheses:—Electric ranges, 31,973 (29,480); water heaters, 47,796 (42,803); milking-machine motors, 14,163 (13,656).

Australian Duties on Batteries

At an inquiry by the Australian Tariff Board regarding the duties on dry batteries and cells, a member of the Board suggested that the increased duty had defeated itself. Local manufacturers asked for the retention of the higher duties which had been proposed. Mr. C. O. Evans, manager of the Widdis Diamond Dry Cells Pty., Ltd., said that before the tariff operated the 45-V heavy duty "B" battery sold at 25s. retail, and a similar Australian battery sold at 20s. In March, 1931, the price was reduced to 18s., or 10 per cent. on the local article and 28 per cent. on the imported line. Mr. Evans said his company's production had gone down 50 per cent., and Mr. W. S. Kelly, a member of the Board, said that the

last increase had proved the company's undoing. It had induced other firms to come into the field, increasing overhead costs. The result appeared to have been disappointing.

Giving evidence against the higher duty, Mr. F. W. Nicholls, manager of Ellis & Co. (Australia), Ltd., said that on the various types of "Columbia" batteries which were previously imported the duties actually represented 87½ per cent. to 200 per cent. British preferential, and 110¾ to 300 per cent. foreign. On a brand of dry batteries made in England, in which his company was interested, the British preferential duty on the various types equalled 118¾ to 238 per cent. He contended that the present duties were prohibitive, and that such alterations as had taken place in the position since the last inquiry had still more firmly closed the door against importations. If the local manufacturer's contention that his product was equal to the imported article was correct, then the last vestige of claim for higher duty disappeared.

Mr. Hugh Smart, of H. Smart & Co., Australian representatives of Britannia Batteries, Ltd., said it was quite obvious that even at the old rate of duty the battery which his company handled would have to be sold at a higher rate than the Australian-made battery, which had been given an absolute monopoly for nearly two years.

Employment During November

According to the *Ministry of Labour Gazette* employment in the engineering industry during November showed little general change and remained very bad. The total out of work was 266,439, as compared with 268,527 in October, the percentage declining from 27.5 to 27.3. In electrical engineering employment was moderate, the unemployed amounting to 15,199, as against 15,034; the percentage increased from 16.0 to 16.2. There was an increase of 2,349 in the number out of work in the electric cable, wire and lamp manufacturing group, bringing the number up to 14,654; the percentage was 12.5, as against 10.5. In the electrical wiring and contracting industry, however, there was a decrease from 4,379 to 4,220 (from 17.5 to 16.8 per cent.).

The Czechoslovakian Radio Market

In normal conditions there is a good market for radio apparatus in Czechoslovakia, says a recent Department of Overseas Trade report, but at present business is very slack owing to trade depression and to the restrictive effects of the foreign exchange control. A year ago, before events took their present unfavourable turn, local trade circles estimated that this country could easily and rapidly absorb another million sets without becoming saturated. In present circumstances such opportunities are definitely in abeyance. The unsuitability of British goods, and a tendency to be behindhand in the production of new models are still occasionally mentioned as reasons for the small amount of radio apparatus of United Kingdom manufacture sold.

Modern Showroom Lighting

The accompanying illustration of the Dublin showroom of the Singer Sewing Machine Co. is an excellent example of shadowless illumination, which has been obtained by the installation of Siemens "Ultralite" totally enclosed fittings and lamps. The provision of a glass top in place of the usual metal canopy greatly improves the light distribution.

A modern showroom illuminated by Siemens' fittings

Recent Contracts

South African Coal Estates, Ltd., have placed with Messrs. Mavor & Coulson's South African subsidiary company at Johannesburg a large order for coal-cutting machinery for the production of the coking coal required by the new steel works at Pretoria. This contract has been pending for some time, and there was considerable competition from American firms.

For the operation of the signalling equipment used in the Southern Railway's Brighton electrification scheme the D.P. Battery Co., Ltd., has supplied the following batteries:—Seventy "T.I." nine-plate cells, having a capacity of 144 Ah at the ten-hour rate, for Three Bridges; fifty-six similar cells for Haywards Heath; and two batteries each consisting of sixty "W.S." 11-plate cells, having a capacity of 500 Ah at the ten-hour rate, for Brighton.

The Sheffield Radium Centre (a branch of the National Radium Commission) is to be equipped with a deep X-ray therapy apparatus. The cost will be £2,500, and the order has been placed with the Metropolitan-Vickers Electrical Co., Ltd. The equipment is the gift of an anonymous donor, and will be used in conjunction with radium and surgery for the treatment of cancer.

New Municipal Offices and Showrooms

Wallasey Corporation has received sanction from the Ministry of Health to the appropriation of land at Conway Street for the purpose of erecting a showroom and offices for the Electricity Department.

The Bermondsey Electricity Committee proposes to adapt the Royal Oak public house, Union Road, as an electrical showroom, at a cost of £1,458.

The Radio Market in Estonia

According to a Department of Overseas Trade report, the Estonian radio market is not a large one, but the import figures show a tendency to increase; local production accounts for between 60 and 65 per cent. of the total trade. Only two or three British manufacturers are represented in the local market, the reason given being that United Kingdom apparatus is sold at about 70 per cent. above the Continental prices. For future trade prices must be competitive; great results and a large turnover cannot be expected at any time.

Salaries in the Electricity Supply Industry

We are informed by the National Joint Board of Employers and Members of Staff (Electricity Supply Industry) that the variation in the cost of living will not involve any alteration in the schedule of salaries of technical engineers on the staffs of authorised undertakers on January 1st.

Prices of Materials

Messrs. Edward Till & Co. report, December 28th:—India-rubber, Para fine, no change.

Messrs. James & Shakespeare report, December 28th:—Copper bars (best selected), sheet and rod, no change. English pig lead, £12 10s., 5s. dec.

Messrs. F. Smith & Co. report, December 28th:—Electrolytic copper bars, sheets and wire rods, no change. Electrolytic copper h.c. wire, 6⅜d., $\frac{1}{16}$d. dec. Silicium bronze wire, 7$\frac{1}{16}$d., $\frac{1}{16}$d. dec.

Trade in Southern Rhodesia

Southern Rhodesia has suffered severely during the past eighteen months both from the effects of the world conditions and from internal causes, says a recent Department of Overseas Trade report on trade conditions in that country. The United Kingdom retains the major portion of the electrical trade although there is growing competition from the United States. Electrical imports from the United Kingdom in 1930 (with 1929 figures in parentheses) were as follows:—Batteries £5,124 (£4,379); lamps, £4,014 (£6,828); radio instruments, £3,111 (£3,531); general electrical materials, £11,116 (£6,594); electrical machinery (excluding motors and transformers), £91,009 (£88,769).

Conditions in Venezuela

In a Department of Overseas Trade report on economic conditions in Venezuela up to August, 1932, the acting British Consul at Caracas remarks that the hopes of a continued development of the country and the consequent opportunity for the expansion of British trade have not been realised. Although Venezuela has suffered less on account of the world slump than most countries and the financial position of the Government is quite sound, the effect on general trade has been sharply felt. About Bs. 6,500,000 of electrical materials was imported during twelve months, the greater part coming from the United States, Germany and Belgium sharing second place, the United Kingdom being a long way behind. Practically all of the plant in this country is of American installation and preference is given to American fittings, the German and Belgian articles finding a market solely on account of their price. It is difficult for United Kingdom articles to compete on account of their high cost.

Davidson & Co.'s Progress

Despite unusually difficult trading conditions, Messrs. Davidson & Co., Ltd., are able to report a fairly busy year, both in so far as actual activity in the shops is concerned

and also from the aspect of development work in their various lines of manufacture, comprising "Sirocco" products. In power-house work the problems presented by modern systems of powdered fuel firing have resulted in considerable research regarding new designs of mechanical draught equipment and dust-collecting plant. The year has witnessed the practical completion by the company of the Dunston power station contract, claimed to be the largest ever placed for mechanical draught plant including dust collecting equipment, while many other important contracts for similar installations at North Tees, Woolwich, Battersea, Ironbridge, Deptford West, and Canton power stations have also been undertaken. Considerable development work has also been carried out on pneumatic conveying plant for the local transportation of ashes, &c. Several important contracts were obtained for heating, ventilating, steam removal and air conditioning and installations.

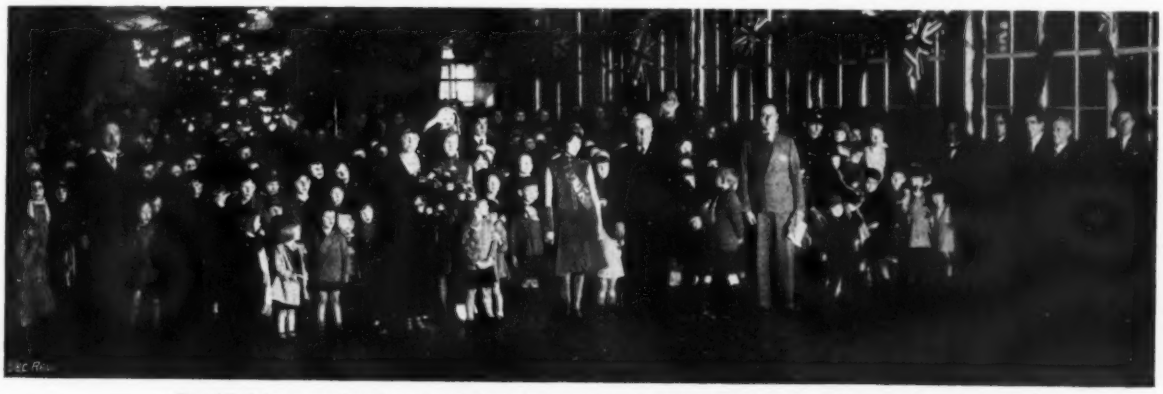
Trade Announcements

Dualite, Ltd., has taken over larger premises at 32, Brook Street, Holborn, E.C.4.

Messrs. Harwell, Ltd., The Sessions House, Clerkenwell Green, E.C.1, inform us that they are the sole selling agents to the wholesale trade for the products of the P.H. British Electrical Works, Ltd.

Social Events

Britannia Batteries, Ltd., recently entertained 730 children of their Redditch employés to a Christmas party. The party was held in the works canteen, which had been gaily decorated. A fireproof cinematograph cabin with apparatus had been installed, and the children's favourites, Charlie Chaplin and Tom Mix pictures, were shown. A string orchestra under the direction of Mr. E. G. Freeman, "Pertrix" sales representative for Birmingham, played carols and popular tunes, and the children joined in the vocal numbers. Mr. R. A. Bachman, managing director of the company, received the guests, and after tea the children were given presents from a huge Christmas tree.



The Christmas party given by Britannia Batteries to children of their Redditch employés

The Benjamin Social and Athletic Club held a Christmas party and dance on December 16th. Between seven and eight hundred club members and friends spent an enjoyable evening. The company included Mr. Guy Campbell, managing director of the Benjamin Electric, Ltd., and president of the Club, and also Messrs. E. S. Dumont and A. E. Iliffe, directors. Mr. Shawyer acted as M.C.

A Manchester Section of the Electrical Power Engineers' Association is holding a social evening and dance on January 14th at the Grand Hotel, Piccadilly, Manchester. Tickets (3s. each) can be obtained from Mr. F. Millien, "Roche Vale," 269, Rochdale Road, Bury.

Calendars and Diaries

The diary received from Ateliers de Constructions Electriques de Charleroi includes conversion tables, cable and wire tables, and notes on the company's products and some of the orders it has received. It is bound in maroon leather. The company has also sent us a handsome and most useful desk pad.

As captivating as ever is the maiden whose portrait adorns the 1933 Mullard calendar.

A reproduction of an old painting "Standing the Test" illustrates the calendar of Messrs. Fitter & Poulton, Ltd.

The West Gloucester Power Co.'s calendar comprises daily slips with Shakespearian quotations on a plain blue background.

The calendar of Dexine, Ltd., is formed of large easily readable monthly sheets bearing particulars of some of the company's products.

A sketch of their old-world premises at Staple Inn makes an artistic subject for Messrs. Lionel Robinson & Co.'s calendar.

The 1933 souvenir received from Venner Time Switches, Ltd., takes the form of a useful wallet to contain the motorist's driving licence, insurance certificate, and membership card.

A neat diary for 1933 bound in black soft leather has been received from the Simplex Electric Co., Ltd. A number of useful tables is included.

"Majestic" is the word to apply to the calendar issued by the Marconiphone Co., Ltd., with its excellent painting of Her Majesty the Queen, by A. T. Nowell, R.I.

Exceptionally large figures are used on Messrs. T. J. Grainger and Co.'s wall calendar.

Messrs. Fernand Espir, Ltd., have sent us a refill for their desk calendar.

A photograph of a picturesque spot close to Wigan appears on Messrs. Heyes & Co.'s calendar.

Wages in the Electrical Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry informs us that there will be no alteration in wages on the third pay day in January.

New Australian Radio Companies

Radio companies registered in Sydney recently include: Radio Sales, Ltd. (capital £5,000); and the Australian Radio Corporation, Ltd. (capital £10,000).

Economic Conditions in Sweden

The December issue of the *Swedish Economic Review* states that on the whole no great changes in the country's economic conditions have presented themselves during the last few months. The increased confidence abroad, together with an unusually good harvest at home, contributed towards creating a more sanguine outlook for the future and a hope that the worst of the depression is now past. For the period January-October, 1932, exports of electrical machinery amounted in value to 13,887,000 kr. as compared with 19,368,000 kr. in the corresponding period of last year, while telephone and telegraph apparatus exports show a decline from 12,605,000 to 6,373,000 kr.

The Lighting of Westminster

A lighting conversion scheme has just been completed in forty-three of the 64½ miles of streets in the area of the Westminster Electric Supply Corporation, forty-six miles of which are now electrically lighted. Upwards of 1,100 special fittings with refractor glass and white enamelled reflectors were designed by the Revo Electrical Co., Ltd. The capacities of the lamps vary from 300 to 750 W per fitting, and the maximum load is 600 kW. The average intensity in the area has been doubled for the same wattage with a guaranteed minimum illumination. Photometric tests show that 37 per cent. of the total lumen emission of the sources is projected to the road surfaces. A example of the new lighting is illustrated on page 965.

New Catalogues and Lists

Ferguson, Pailin, Ltd., Higher Openshaw, Manchester.—A booklet dealing with the necessity for switchgear and adequate rupturing capacity.

Stanton Ironworks Co., Ltd., near Nottingham.—A leather-bound pocket book containing, in addition to useful statistics relating to Stanton products, a replaceable notebook.

E. N. Bray, Ltd., Whipps Cross Works, Wood Street, Walthamstow, E.17.—Leaflet No. 50, introducing the company's new type "R.S." hand-operated stator and rotor starter for slip-ring motors.

Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.—An illustrated catalogue (No. H.C.809) of "Ediswan" fires.

Eric J. Lever (Trix), Ltd., 8-9, Clerkenwell Green, E.C.1.—A price list of mains tranformers and chokes, introducing several new types.

Laurence, Scott & Electromotors, Ltd., Norwich.—Pamphlet No. 890, dealing with flameproof motors for mines, chemical works, petrol and oil pumping, &c.

Heyes & Co., Ltd., Water-Heyes Electrical Works, Wigan.—The December issue of the "Wigan Review" containing particulars of "Wigan" bells and relays.

Richard Johnson, Clapham & Morris, Ltd., Jacem House, Trafford Park, Manchester.—An illustrated list (No. E.12/32) of domestic electrical appliances.

Adam Hilger, Ltd., 98, King's Road, Camden Road, N.W.1.—Publication No. 173/2 describing an X-ray metallurgical crystallograph for the examination of the effects of heat and

mechanical treatment on metal. Also a price list of specially pure iron rods.

Archibald Low & Sons, Ltd., Merkland Works, Partick, Glasgow.—An illustrated price list (No. 932) of "Highlow" tubular heaters, low temperature radiators, circulators, heat storage tanks. Prices of tubular heaters have been reduced considerably.

Sir W. G. Armstrong Whitworth & Co. (Engineers), Ltd., Thames House, Westminster, S.W.1.—An illustrated brochure entitled "Diesel Traction Progress."

British Engine Boiler & Electrical Insurance Co., Ltd., 56, Kingsway, W.C.2.—A card indicating the various types of insurances effected.

George Ellison, Ltd., Perry Barr, Birmingham.—A booklet dealing with oil-break and oil-immersed switchgear installation and maintenance.

Siemens & General Railway Signal Co., Ltd., Central House, Kingsway, W.C.2.—A pamphlet (No. S.G.E.3) relating to Edison primary cells.

Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, N.7.—A coloured window poster.

Bankruptcy Proceedings

P. Howden, radio dealer, trading as the "Bradford Radio Service," 73, Otley Road, Bradford.—At the first meeting of creditors held at the Official Receiver's Office, 71, Manningham Lane, Bradford, on December 16th, a statement of affairs was submitted which showed gross liabilities of £323, of which £265 was estimated to rank for dividend. The deficiency amounted to £235. The failure was attributed to bad trade and insufficient capital. The case being a summary one was left in the hands of the Official Receiver, as trustee.

W. H. Talbot (trading as City Radio Supplies), electrical dealer, Penny Street, Blackburn.—The public examination was held recently at the County Court House, Blackburn. A deficiency of £271 was shown, and the debtor attributed his failure to "shortage of capital, bad trade and illness." The Registrar, in adjourning the examination, requested an account of all moneys received and paid by debtor over the full period during which he carried on business as a radio dealer.

J. E. Cookson, wireless dealer, 36, St. Mary's Road, Penketh, Lancs, lately trading as J. E. Cookson & Co., 395, Liverpool Road, Great Sankey.—The public examination was held recently at the Court House, Warrington. The debtor had returned a statement of affairs which showed unsecured liabilities of £610, and assets estimated to realise £28, leaving a deficiency of £582. The examination was closed.

J. D. Drury, electrical engineer, 23, Strathmore Drive, Great Crossley, near Liverpool.—Receiving order made December 21st on a creditor's petition. First meeting January 3rd at the Official Receiver's office, Government Buildings, Victoria Street, Liverpool. Public examination February 7th at the Court House, Victoria Street, Liverpool.

H. Bannister (H. Bannister & Co.), electrical goods factor, 48, Old Mote Lane, Withington, Manchester.—Receiving order made December 14th on a creditor's petition.

C. Holdroyd, electrical engineer, 87, Buchanan Street, Blackpool.—Public examination January 13th, at the Court House, South King Street, Blackpool.

G. M. Jacob, wireless dealer, 29, Dimond Street, Pembroke Dock.—Public examination, January 23rd, at Shirehall, Haverfordwest.

A. C. Clewley (Radioland), electrical goods factor, 21, Portland Street, Walsall.—Last day for receiving proofs December 31st. Trustee, Mr. C. Hoult, 159, Great Charles Street, Birmingham, Official Receiver.

G. Howard (the younger), electrical engineer, 10, Alford Grove, Sprowston, Norfolk.—Receiving order made December 16th on debtor's own petition.

M. Goldsmith (Regent Radio Co.), wireless dealer, 24, Russell Street, Plymouth.—Public examination January 20th at the Western Law Courts, Guildhall, Plymouth.

R. T. Styles, radio dealer, 132, Somers Road, Southsea.—Receiving order made December 12th on a creditor's petition. First meeting January 2nd at the Official Receiver's office, 87, High Street, Portsmouth. Public examination February 6th at the Court House, St. Thomas's Street, Portsmouth.

C. D. Bruce, electrical engineer, 67, Bold Street, Altrincham.—Last day for receiving proofs for dividend January 4th. Trustee, Mr. F. Murgatroyd, Byrom Street, Manchester, Senior Official Receiver.

G. E. Hughes, electrical engineer, 90, Gibbet Street, Halifax.—First and final dividend of 10¼d. in the £, payable December 30th at the Official Receiver's office, 71, Manningham Lane, Bradford.

Company Liquidations

Premier Electric Welding Co., Ltd.—Winding up voluntarily. Liquidator, Mr. R. W. Liddell.

"Ibex" Manufacturing Co., Ltd.—Winding up voluntarily. Liquidator, Mr. E. J. Wright, 69, Halstead Road, Winchmore Hill, N.

Whitchurch and Pangbourne Electric Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. H. Fraser.

R. S. Mackereth, Ltd.—Meeting January 23rd at 411, Castle Street, Liverpool, to receive an account of the winding up by the liquidator, Mr. P. W. Ardran.

Regent Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. R. J. Hayward, 103, Cannon Street, E.C.

Allerton Electrical Supplies, Ltd.—Winding up voluntarily. Liquidator, Mr. H. A. G. Langton, 76, Merton Road, Bootle.

Dissolutions of Partnership

Wakeley & Day, electrical engineers, &c., 16, The Grangeway, Winchmore Hill.—Messrs. F. A. Wakeley and K. G. A. Day have dissolved partnership. Mr. Wakeley will attend to debts and carry on the business.

Invicta Electrical Supplies Co., wholesale distributors of electrical accessories and cables, 18 and 19, Grand Parade, Norbiton.—Messrs. L. H. Ransom and A. E. Hollands have dissolved partnership.

Electricity Supply

Lighting, Domestic, Power

Alsager (Cheshire).—REQUEST FOR EXTENSIONS.—The Urban District Council is to ask the Electricity Distribution of North Wales and District, Ltd., to extend its overhead service to Linley.

Bampton (Oxford).—ELECTRICITY IN THE SUMMER.—Early next month work will be started on the erection of overhead lines to supply Bampton, and it is hoped that electricity will be available by the beginning of the summer.

Caistor.—OVERHEAD LINES.—The Rural District Council has consented to the Yorkshire Electric Power Co.'s using overhead lines in its area for the supply of electricity.

Canterbury.—INQUIRY.—Mr. Henry Nimmo, chief engineering inspector to the Electricity Commissioners, held an inquiry at the Guildhall on December 19th and 20th, into an application by the Corporation for permission to extend its area of supply. The application was opposed by the Kent Electric Power Co. and the South-East Kent Electric Power Co., Ltd. (which were jointly represented by Mr. Tyldesley Jones, K.C., and Mr. Sidney Turner, K.C.), and by the Kent County Council and other local authorities.

Chatham.—SUPPLY TO WALDERSLADE DISTRICT.—At the request of the Walderslade and District Ratepayers' Association, the Town Council has decided to approach the Kent Electric Power Co., Ltd., with reference to a supply of electricity for domestic purposes for the Walderslade district.

China.—HYDRO-ELECTRIC STATION FOR KOREA.—The largest hydro-electric power installation in the Far East, known as the Fusenko, was recently completed on the Fusenko River, Korea. The plant comprises four Pelton horizontal single-wheel turbines, built by the J. M. Voith Co., directly coupled to the generators. The turbines work under an effective head of 2,180 ft., each set developing 50,000 h.p. During official tests a maximum efficiency of almost 92 per cent. was obtained.

Fordingbridge.—SUPPLY INAUGURATED.—A supply of electricity provided by the West Hampshire Electricity Co., Ltd., was inaugurated on December 15th by the Hon. Lady Hulse of Breamore at the Town Hall. The ceremony was followed by an electrical exhibition and demonstration.

France.—NEW PARIS STATION.—Work is approaching completion on the construction at St. Denis of the second large generating station in that suburb for the supply of electricity in the Paris district, and it is expected that the first 40,500-50,000-kW steam turbo-generator will be ready for operation early in the new year.

CONSUMPTION DECLINING.—According to the *Revue Générale d'Electricité*, the output of the fifty principal power stations in France, representing about 62 per cent. of the total production, amounted during the nine months ended September last to 6,435,882,219 kWh, as compared with 6,909,895,400 kWh in the corresponding period of 1931. Of the total hydro-electric plants were responsible for 3,614,146,303 kWh, and thermal and internal-combustion engine stations for 2,821,735,916 kWh.

A NOVEL HYDRO-ELECTRIC POWER STATION.—A novel hydro-electric power station is in course of construction in Alsace. The water of Lake Blanc, after passing from the power station to Lake Noir, is pumped back to the upper storage lake, the main difference in level being 383 ft. The plant is being equipped by Escher, Wyss & Co., Zurich, with four 38,200-h.p. vertical-shaft Francis turbines and with four storage pumps direct coupled to them. Three of the pumps require a maximum driving power of 27,000 h.p. each. In each set the pumps are mounted underneath, then the turbines, and on top the generators, all three machines being rigidly coupled together.

POWER STATION THREATENED BY LANDSIDE.—A landside is threatening to bury the power station at Font Pedrouse, which supplies the railway from Villefranche to Font Romeau.—*Reuter* (Paris).

Fraserburgh.—DEMAND FOR ELECTRICITY.—A communication received from the Grampian Electricity Supply Co., states that its Special Order has been approved by both Houses of Parliament and that its engineers are making a preliminary survey and giving consideration to a supply for the whole area. In the meantime no indication can be given as to when the works will be started; they cannot, however, be commenced at Fraserburgh this winter. The Town Council has unanimously agreed to urge the necessity for an early start with the laying of mains in the town.

Germany.—ELECTRIC COOKING AND WATER-HEATING.—At the recent annual meeting in Berlin of the German Vereinigung der Elektricitätswerke, a report was presented which showed that at the beginning of 1932 approximately 76,000 domestic electric cookers, 42,000 water heaters, 500 large cooking installations, and electric ovens in 500 bakeries were in use throughout Germany.

Glasgow.—GOOD PROGRESS.—Under the Electricity Department's scheme 155 houses were wired in November, making a total of 36,799, while forty-five hired appliances were installed, bringing the total to 19,136.

MAINS EXTENSIONS.—Distributing mains are to be laid at a cost of £7,450.

REWIRING.—The Health Committee is to rewire the Sanitary Chambers at a cost of £450.

Gnosall.—SUPPLY TO MORETON.—The Rural District Council is to ask the North West Midlands Joint Electricity Authority to give a supply of electricity to the parish of Moreton.

Grays.—ELECTRICITY CHARGES.—The Urban District Council has decided that electricity supplies through prepayment meters shall be charged for at the rate of 6d. per kWh, less a rebate of ½d. in the £1. Discounts upon quarterly accounts have been altered to 5 per cent. for prompt payment.

Japan.—NEW POWER STATION.—Preparations will be made early in the New Year by the Nippon Denryoku K.K. for the erection of its proposed 65,000-kW Tsurigane power station; the work will be completed in two or three years. The Ujigawa Electric Co. is also proposing to proceed with the erection of its Nagatono station (10,000 kW) on the Obara River. In addition, applications have been filed for the operation of thermal power stations by the Sanyo Central Hydro-electric Power Co. (35,000 kW), the Kobe Municipal Electric Bureau (35,000 kW), the Osaka Municipal Electric Bureau (10,000 kW), and the Nankai Railway Co. (10,000 kW).

Lichfield.—DISSATISFACTION OVER RURAL SUPPLIES.—A resolution was passed at a recent meeting of the Rural District Council to the effect that having given Lichfield Corporation powers to supply electricity in its district, the Council was not satisfied with the rate at which the work was being carried out and contemplated applying for a Fringe Order.

Lithuania.—POWER STATION PROPOSAL.—An American syndicate has recently submitted a scheme to the Lithuanian Government for the construction of a large power station on the River Memel, near Petrachiuana. The Government is reported to have accepted the proposal in principle but to have decided to invite competitive offers from electrical concerns in other countries.

Llanidloes.—COUNCIL'S ELECTRICITY SCHEME.—As it objects to the application for a Provisional Order by the Llanidloes Electric Light Co., Ltd., the Town Council has decided to engage an expert to advise as to the various possibilities of providing a complete supply of electricity for the town, and as to the process and details of the Council's procuring a Special Order itself.

London.—FULHAM.—If an Electricity Committee recommendation is carried, rental wiring contractors will be allowed to use lamps of British manufacture other than those made by members of the Electric Lamp Manufacturers' Association, subject to their agreeing to a reduction of 3d. per lighting point in the schedule of prices where such lamps are used, and subject to the production of a satisfactory certificate of efficiency from the National Physical Laboratory in respect of the lamps.

BERMONDSEY.—Application is to be made by the Electricity Committee for sanction to the borrowing of £40,000 for mains, services and installations.

A new main costing £950 is to be laid from the Neckinger sub-station to Grange Road.

STOKE NEWINGTON.—Sanction has been obtained by the Electricity Committee to a loan of £5,000 for electricity meters.

POPLAR.—The Electricity Committee has authorised the gradual elimination of the commutator type of meter, and the purchase from undertakings which have changed over to a.c. of their stocks of new and second-hand d.c. meters of the mercury motor type.

Manchester.—PROGRESS DURING NOVEMBER.—Last month there was an increase of 3,324 kW in the Electricity Department's connections, making a total of 520,175 kW, while applications for supplies (including additional supplies) numbered 2,396, representing a total of 3,964 kW. There were 205 new cookers connected, bringing the total on circuit to 10,705, and orders for the hire of cookers amounted to 212. Two new sub-stations were put into commission and new plant was installed at the Booth Hall Infirmary sub-station. The output to feeders during the month was 46,164,000 kWh, an increase of 2,072,000 kWh as compared with November, 1931.

Montgomery.—PROGRESS OF SUPPLY SCHEME.—The North Wales Power Co., Ltd., has commenced the laying of underground mains for a supply of electricity to Montgomery, and the supply is expected to be available by the middle of January.

New Zealand.—THE WAITAKI POWER SCHEME.—On account of the heavy reduction in this year's appropriations for hydro-electric development, the completion of the Waitaki River scheme will be postponed until 1934 unless funds are available next year on a more liberal scale. The *New Zealand Engineer* states that according to the public works estimates tabled in the House of Representatives, the vote for this scheme for the year ending March 31st, 1933, is only £173,000, compared with an actual expenditure last year of £428,626. When it was authorised the work was estimated to cost £2,000,000, of which £1,580,682 had been spent at March 31st, 1932.

Poland.—ELECTRICAL DEVELOPMENT PROPOSALS.—The Polish Cabinet is at present studying a Bill to encourage electrical undertakings in Poland, says *Reuter's Trade Service* from Warsaw. The proposal is to afford important financial and legal facilities to electrical enterprises, especially in the east of the country. The Cabinet will also shortly consider a proposal to amend the present law regarding the electrification of the country, which will, among other things, simplify the procedure for obtaining concessions for the erection of power stations.

Sarratt (Herts).—INAUGURATION OF SUPPLY.—A supply of electricity was inaugurated on December 19th, the switching-on ceremony being performed by Mr. F. V. Barrett, chairman of the Parish Council, who was presented with an electric clock by Mr. R. J. J. Swan, secretary and engineer of the Chesham Electric Light and Power Co., Ltd. A two days' electrical exhibition followed.

Sedgefield (Co. Durham).—PUBLIC LIGHTING.—The Parish Council has entered into a new agreement with the North-

An example of well-diffused lighting at All Saints' Church, Southport. G.E.C. equipment was used

Eastern Electric Supply Co., Ltd., for public lighting for a period of three years. The lighting is to be extended along the main road to Durham as far as the Isolation Hospital.

Stoke-on-Trent.—BULK SUPPLY.—The Electricity Committee is to give the North-West Midlands Joint Electricity Authority a small bulk supply at Norton.

MAINS EXTENSIONS.—Mains extensions costing £300 are to be carried out to supply premises in Sandon Road, Meir.

Strood.—SUPPLY ARRANGEMENTS.—Shorne Parish Council, having requested the Rural District Council to apply to the Kent Electric Power Co., Ltd., for a supply of electricity to Lower Shorne, has been informed that the matter is receiving attention. With reference to a supply at Salt Lane, Cliffe, the company has intimated that the proposal is not practicable, as it would mean laying a fresh cable for over a mile from the main line.

Sunderland.—LOANS SANCTIONED.—The Town Council has received sanction to the borrowing of £1,020 for the erection of a sub-station, £5,751 for mains and services, and £6,000 for sub-station equipment and switchgear.

Swansea.—EXTENSIONS.—Arrangements have been made to supply electricity to Messrs. Kinnear Moodie & Co., Ltd. (contractors carrrying out a portion of the main drainage scheme) at a cost of £902, and to Messrs. Wm. Edwards & Co., Ltd. (£1,045.) Sanction to a loan of £20,000 for mains and services has been applied for and mains are to be extended at a cost of £250 to supply premises in Blackpill.

Tipton.—SPECIAL ORDER STILL OPPOSED.—At its last week's meeting the Urban District Council decided still to withhold, pending further information, its consent to the application of the Midland Electric Corporation for Power Distribution for a Special Order to extend the latter's period of tenure until 1972. The Council is the only one of twenty local authorities now opposing the Order.

Usk.—DEMAND FOR ELECTRICITY.—The Urban District Council has received a petition signed by about 120 people asking for the provision of electricity supplies.

Wakefield.—LOANS.—The Electricity Committee is applying for sanction to loans of £25,000 for mains and services, £5,000 for meters, and £5,000 for hired apparatus.

Wimbledon.—BEWARE, ELECTRICITY THIEVES!—According to the *Evening Standard*, the Town Council proposes to promote a private Bill in Parliament with a view to putting an end to frauds by consumers who take electricity for lighting from power points. If the Bill is passed any consumer who uses the power supply improperly will be liable to a penalty not exceeding £5 and 40s. for each day of improper use; he will also have to pay the full lighting rate for the energy consumed. The Council is also to ask for powers to refuse supply to anyone convicted of this offence.

Wirral.—REDUCED CHARGES ASKED FOR.—The Rural District Council is to send a deputation to Birkenhead Corporation to discuss the reduction of charges for electricity in Wirral.

Woking.—INVESTIGATION INTO ELECTRICITY CHARGES.—A sub-committee has been appointed by the Town Council to investigate the charges made for electricity in the district.

Traction

Argentina.—THE BUENOS AIRES UNDERGROUND CONCESSION.—Buenos Aires Council has unanimously adopted a motion declaring the concession accorded to the Anglo-Argentine Tramways Co., Ltd., to build a new underground line to be lapsed.—*Reuter* (Buenos Aires).

Australia. — ELECTRIFICATION PROPOSAL. — The Newcastle (N.S.W.) City Council is considering a proposal for the electrification of the line between Newcastle and Sydney, and has asked the Minister of Transport for an estimate of the cost and the saving in running time of an electric system as compared with steam.

Bootle.—THE TRANSPORT SERVICES.—The Town Council is to promote a Bill in Parliament giving it powers to run bus services and abandon the tramways.

France.—NEW LINES OPENED.—Two new metre-gauge electrified lines, with a total length of over fifty miles, have just been opened in the south-west of France. Running from Castres to Toulouse, and Castres to Revel, the routes include numerous grades of 1 in 40 and 1 in 30, and are worked by 400-h.p. double-bogie motor coaches with trailers. The d.c. system at 1,500 V is employed, and the coaches are provided with rheostatic braking.

Germany.—DIESEL-ELECTRIC TRAIN.—An experimental Diesel-electric two-coach train built to the order of the State Railway Company by the Görlitz coachworks, on December 19th made the return journey between Berlin and Hamburg, a distance of 286 kilometres (178 miles) in about 140 minutes each way, the average speed reached being about 75 miles an hour, says *The Times*. The regular express, the fastest steam train running in Germany, makes the run in about 179 minutes.

The "Flying Hamburger" consists of two coaches, each with a blunt and a rounded end. The blunt ends are closely coupled together, and in the nose of each coach is a 400-h.p. Maybach Diesel engine operating a dynamo, the power from which is transmitted to motors driving the wheels. Great attention has been paid to streamlines, and the coachwork is carried down well beneath platform level, so that the wheels are barely visible behind the "skirting." The two saloon coaches can contain 100 passengers, and there is a small refreshment room. As each extremity of the train contains a driver's compartment and a Diesel engine it can be driven in either direction. A picture of the train appeared in our issue of October 7th, page 516.

Japan.—ELECTRIFICATION EXTENSIONS.—It is reported that the I.G.R. has decided to extend its electrified system from Niffori to Matsudo, a distance of about 20 km. The electrical equipment required will cost about 800,000 yen.

Southern Railway.—OPENING OF THE BRIGHTON ELECTRIFIED LINE.—On Sunday the newly electrified main line service to Brighton and Worthing will be opened to the public. The first section of the line from London to Three Bridges was opened in July last, when we published (July 8th, p. 43) a detailed description of the scheme and the electrical equipment. Special rolling stock, the traction equipment for which was supplied by the British Thomson-Houston Co., Ltd., will be employed for the new express services, and will comprise twenty-three six-coach units and three five-coach all-Pullman units for the "Southern Belle." The six-coach unit is composed of five corridor coaches and one Pullman car, the two end coaches being motor coaches. Two units coupled, forming a twelve-coach train, will be used during rush hours. Each motor coach equipment includes four 225-h.p. traction motors, electro-pneumatic control gear underframe mounted, motor-driven compressors, and motor-generators for lighting and control circuits.

A LANDSLIDE CAUSES DELAY.—A small landslide between Tooting Junction and Streatham disorganised traffic on the Sutton-Holborn Viaduct electric service for several hours on Thursday morning last week.

Sweden.—RAILWAY ELECTRIFICATION PROGRESS.—The electrification of the Stockholm-Malmö main line with certain junction lines is proceeding very rapidly, says *Reuter's Trade Service* from Stockholm. Since the beginning of August the important industrial centre Norrköping, 163 km from Stockholm, has been within reach of the capital by electric trains, and now another section, between Norrköping and Mjoelby (78 km), has been added to the electrified system, nine months earlier than provided for in the original scheme. Successful experimental electrical services have already been tried out on the connecting line between Falköping (on the Stockholm-Gothenburg main line) and Naessjö (on the Stockholm-Malmö main lane), a distance of 113 km., although the programme did not provide for the completion until next April. A parallel connecting line, between Mjoelby and Hallsberg (96 km.), which also unites the above-mentioned main lines, is practically completed, and the first ordinary electric trains will begin to run on the line in the New Year, five months earlier than expected. The only part of the programme established in 1931 which now remains to be executed is the Mjoelby-Naessjö-Malmö-Trälleborg section of about 400 km., which, according to the plan should be completed in April, 1934, but will probably be ready for traffic by the end of next year. Meanwhile work will certainly have started on the realisation of a third electrification scheme (the Stockholm-Krylbo-Aange main line), a distance of 484 km.

Communications

Cuba.—NEW RADIO STATION.—The International Broadcasting Co., Havana, recently inaugurated a new transmitter. Its call signal is CMAF and it uses a frequency of 680 kc/s with a power of 1 kW.

Egypt.—INTERNATIONAL CABLE CONGRESS.—The next International cable and wireless congress will be held in Cairo in 1937. The congress meets every five years. The last was held in Madrid.—*Reuter* (Cairo).

EGYPT-INDIA TELEPHONE NEXT YEAR.—Egypt and India are to be linked by radio-telephone. The service is expected to be inaugurated in March next.—*Reuter* (Cairo).

Great Britain.—RADIO RELAY EXCHANGES.—The South Shields Corporation Highways Committee has informed Mr. W. G. Denny, of Clacton-on-Sea, and Rediffusion, Ltd., of London, that the Corporation is not prepared to approve of the operation of wireless relay services in the borough.

The Grays Urban Council has refused an application by Wireless Services, Ltd., for permission to establish a service in the town.

The Truro Corporation Improvement Committee has been notified by the National Broadcast Relay Company that its offer to install systems had definitely been accepted by the March (Cambs.) U.D.C., and it was expected that at the end of the month Newmarket, Maldon, Dorchester, Shoeburyness, Godalming, Fareham, Saffron Walden, etc., would ratify proposals which were at the moment under consideration. The town clerk has been asked to approach H. T. P. & Co., J. H. Deeble & Co., the Truro Radio Co., G. Lawrence & Co., and the Truro Electric Supply Co., as to whether or not they would be prepared to install a system.

Kingston-on-Thames.—RADIO AERIALS.—Tenants of council houses at Kingston-on-Thames, Surrey, are not to be allowed to erect wireless aerials without the consent of the Town Council and surveyor.

London.—"CETEX" TELEPHONE SERVICE.—A "repository" for London telephone messages is to be set up in the New Year. Subscribers to this new enterprise, which is a private concern under licence of the Postmaster-General, with offices in Grosvenor Place, S.W.1, before going out will ask their local exchange to transfer calls for them to "Cetex, Limited," which will record any messages. On return the subscriber will ring up "Cetex," quoting a private number which identifies him, and messages will be repeated to him.

Russia.—NEW SOVIET RADIO STATION.—A powerful radio station, "generating 500 kilowatts," is to start work near Moscow shortly, according to the *Tass Agency*. A 20-kW transmitting station at Rostov-on-Don and a 4-kW station at Lievsk are also to start shortly. The Soviet Union has at present fifty-nine broadcasting stations and the system will be greatly extended in 1933. Several new stations are to be built, mainly in Russia proper, but it is also intended to construct a 100-kW station in Minsk (the centre of the White Russian Republic) and a station of equal power in Kiev, in the Ukraine.—*Reuter* (Moscow).

South Africa.—CAPE TOWN'S NEW RADIO STATION.—Mr. S. M. Wale, director at Cape Town of the African Broadcasting Co., announces that a site has been purchased at Milnerton for the new broadcasting station for Cape Town. Its equipment will be twenty times more powerful than that of the present station.

DURBAN TELEPHONE IMPROVEMENTS.—Col. R. T. McArthur, formerly Union Postmaster-General, who has been retained by the municipality as technical adviser to the Telephone Department, has made recommendations for improvements which have been accepted in principle by the Town Council. Besides proposed changes in message rates and maintenance methods, the gradual replacement of all existing instruments by more modern types, a certain number to be purchased immediately, is urged.

United States.—RADIO COMMISSION'S ECONOMY SCHEME.—Since the transfer of the Radio Division of the Department of Commerce to the Federal Radio Commission an annual saving of approximately £7,000 has resulted, and a further saving of £15,000 a year will be effected by reducing the personnel by thirty-three, says *World-Radio*. Under the new plan the United States will be divided into twenty districts, each in charge of an inspector. The present supervisors will automatically be appointed to these posts, and will exchange territories from time to time to familiarise themselves with operating conditions all over the States.

A CENSUS OF WIRELESS SETS.—At the national census in 1930 householders were asked to state the number of receivers they possessed. The latest figures show that every other family of city dwellers owned a receiver, says *World Radio*, as against only 21 per cent. of rural families. Of the 12,048,762 sets in use when the census was taken 44.4 per cent. were owned by native white families, 43.6 per cent. by foreign-born white families, and only 7.6 per cent. by negro families. There were 29,904,663 families in the United States in 1930, and the returns show that 40.3 per cent. of them owned wireless sets. It is estimated that there are about 18,000,000 sets in the country to-day.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Alyth (PERTHSHIRE).—January 4th. Town Council. Electric lighting installation, &c., for housing scheme. Town clerk.

Ashford.—January 16th. Electricity Department. 33-kV transmission line. (December 23rd.)

Bolton.—January 4th. Housing Department. Electrical installations in 416 houses and flats and five shops on the Johnson Fold Estate. (December 23rd.)

Cupar (Fife).—January 6th. Fife District Asylum. Various materials, including electrical fittings. Resident clerk of works.

Dundee.—January 6th. Public Health Department. Wireless installation at Ashludie Sanatorium, Monifieth. Town clerk.

January 11th. Electricity Department. Cables. (See this issue.)

Egypt.—CAIRO.—February 7th. Ministry of the Interior. Power station of about 660-kVA capacity. (A.X. 11599.)*

January 9th. Electric lighting of new bridge at Benha. (A.X. 11639.)*

SUEZ.—January 21st. Suez Local Commission. Underground armoured cables. (A.X. 11640.)*

Fareham.—Electricity Department. 100-kVA 11,000-V three-phase transformer. (December 16th.)

Galloway.—January 12th. Golloway Water Power Co. Construction of Glenlee power station (foundations and steelwork). Sir Alexander Gibb & Partners, Queen Anne's Lodge, Westminster, S.W.1 (fee of £10 10s.).

Halifax.—January 7th. Improvements Committee. Electricians' work for King Cross development. Mr. D. T. Lloyd Jones, borough engineer, Crossley Street (deposit £2 2s.).

Hull.—January 17th. Electricity Department. Two 200-Ah stationary batteries, charging equipment, switchgear, &c. (December 23rd.)

January 5th. Corporation. Electric lighting and power installation at West Hull Baths. City engineer (deposit £3 3s.).

Isle of Man.—January 9th. Electricity Board. 33-kV transmission lines and pole-mounted switchgear. (December 16th.)

Lochore (Fife).—January 6th. Miners' Welfare Fund Committee. Various works, including electric lighting installation, at Miners' Welfare Institute. Mr. J. W. Anderson, 8, New Row, Dunfermline.

London.—ISLINGTON.—January 20th. Electricity Department.—Electrical and engineers' stores. (December 16th.)

New Zealand.—WELLINGTON.—February 7th. Post and Telegraph Department. 800 bell receivers and 5,000 mouthpieces. (A.X. 11627.)* 600 keys and 200 lamp caps. (A. 11626.)*

Swansea.—January 19th. Electricity Department. Condensing plant for Tir John North power station. (December 16th.)

Thorne.—January 10th. West Riding County Council. Installation of electric lighting at additions to Boys' Council School. Education officer, County Hall, Wakefield.

Walton-upon-Thames.—January 9th. Urban District Council. Transformer kiosk, switchgear, fuse units and cables. (December 16th.)

Wealdstone.—January 5th. Urban District Council. Electric lighting installation at 316 houses. U.D.C. surveyor, Council Offices, Peel Road.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Ashton-under-Lyne.—Electricity Committee. Accepted. Overhead lines Hurst Knoll houing estate.—W. J. Furse & Co.

Birkenhead.—Electricity Committee. Accepted. Electricity supply to Council houses: Thirty at £141, Heaney & Co.; twenty-five at £130, J. McKenzie; thirty-four at £161, Park Electric Co.; sixty-six at £349, J. J. Peters; forty at £184, Seymour & Co.; and two at £9, Trace & Son.

Durham.—County Education Committee. Accepted. Installation of electrical apparatus at the Houghton-le-Spring Council School (£217)) and at Chilton Moor Council School (£66).—Law and Burns. Installation of electric lighting at West Auckland Council School (£63).—R. Robson.

Easington (Co. Durham).—Rural District Council. Accepted. Electric wiring in 200 houses on various sites in the area.—D. McKenzie & Co.

Glasgow.—Corporation Markets Committee. Recommended. Replacements of chill-room plant (£436).—L. Sterne & Co., Ltd.

Municipal Transport Committee. Accepted. Lapwelded steel tubing.—Scottish Tube Co., Ltd. Pantograph collectors, Metropolitan-Vickers Electrical Co., Ltd.

Housing Committee. Accepted. Electrical installation at South Chester Street re-housing scheme (£665).—R. J. M'Intyre.

Hornsey.—Electricity Committee. Recommended. Meters for twelve months.—Reason Manufacturing Co., Ltd.; Ferranti, Ltd.; Chamberlain & Hookham, Ltd. Time switches for twelve months.—Venner Time Switches, Ltd.

London.—FULHAM.—Electricity Committee. Recommended. One 120-ton overhead electric travelling crane and one 15-ton overhead electric travelling crane (£6,052).—Clyde Crane & Engineering Co., Ltd. Foundation work for the new power station (£121,524).—Nuttall & Mowlem (Joint), Ltd.

Sunderland.—Town Council. Two electric cranes (£1,496).—Clarke, Chapman & Co., Ltd.

Tynemouth.—Town Council. Accepted. Cable (£185).—Macintosh Cable Co., Ltd.

Forthcoming Events

Institution of Heating and Ventilating Engineers.—Wednesday, January 4th. Home Office Industrial Museum, S.W. 7 p.m. "Soil Heating by Electricity." Mr. C. A. Cameron Brown.

Institution of Electrical Engineers.—Thursday, January 5th. Institution, London. 6 p.m. "The Economic Problems of the Swedish State Railway Electrification." Mr. I. Ofverholm. (*Wireless Section.*)—Wednesday, January 4th. 6 p.m. "Electronic Oscillations," and "An Investigation of the Magnetron Short-wave Oscillator." Mr. E. C. S. Megaw. (*Meter and Instrument Section.*)—Friday, January 6th. 7 p.m. "Synthetic Corundum for Jewel Bearings." Mr. E. G. Sandmeier.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following:—

MERACOL screen fire (present manufacturers or suppliers). Watertight switch marked with a letter C enclosing an A. The address of the PEMBERTHY SUMP PUMP CO. is required.

In the Courts

MR. JUSTICE LANGTON, sitting as an additional judge of the King's Bench Division last week, delivered a considered judgment in the action brought by N. V. "Splendor" Gloeilampenfabrieken, Holland, to recover from the Omega Lamp Works, Ltd., Wimbledon, royalties amounting to £500 in respect of "tipless" lamps.

The plaintiffs are the registered proprietors of an English patent granted in 1926 for improvements in so-called "tipless" incandescent lamp bulbs and the like sealed envelopes, and by a deed dated in December, 1927, they gave the defendants licence to make and sell lamps under the patent within the United Kingdom in consideration of the royalties thereby derived. The plaintiffs alleged that the defendants had failed to perform their covenant to keep accounts of all matters connected with the licence.

The defendants alleged that the plaintiffs had broken the agreement by not having taken any steps to prevent an infringement of the patent by the original Nelson Electric Company, Ltd., and therefore the licence became determined.

In his judgment, his Lordship reviewed the evidence, stating incidentally that the Nelson Electric Co., Ltd., was not to be confused with the Nelson Electric Lamp Co., Ltd. He was satisfied that the essence of the plaintiffs' invention was really being taken by the former company, and there could be no doubt that the defendants gave the plaintiffs notice of the infringement. The plaintiffs had never issued a writ against the Nelson Electric Co., and they were never really legally proceeded against at all. He came to the conclusion that the patentees did not take "steps" within the meaning of the clause within the specified time. The action therefore failed and would be dismissed.

A Dynamo's Hum

The humming of a wireless dealer's dynamo was further investigated at Burnley County Court on December 21st, after Judge Burgis had visited the premises. The plaintiffs, Mr. and Mrs. F. J. H. Greenwood, an elderly couple, sought an injunction to restrain Mr. J. Muscutt, wireless and electrical engineer, from causing an alleged nuisance with a dynamo at his premises, next door to the complainants' house. A sum of £100 damages was claimed.

Judge Burgis suggested that another silencer might be used. Mrs. Greenwood now reported that since the adjournment the noise had been loud some nights but quiet on others. Since December 14th the machine had been comparatively quiet. His Honour said when he visited the house there was a quiet and moderate sound.

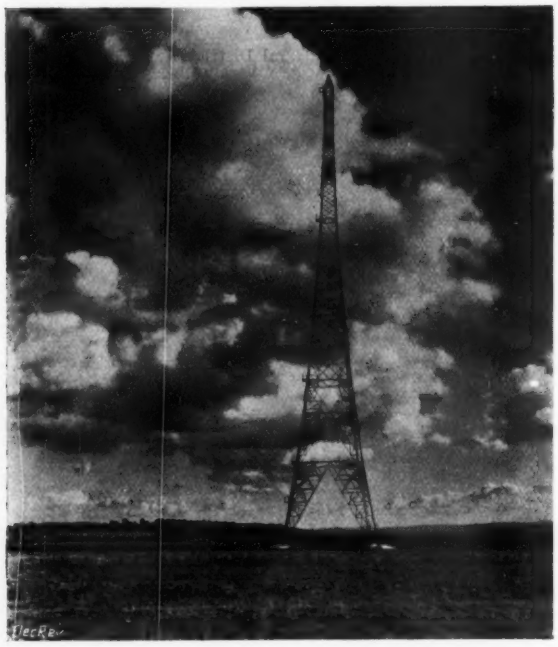
Mr. Muscutt described the steps taken to quieten the apparatus, and contended that the complaints had been exaggerated.

Judge Burgis granted an injunction restraining defendant from using the plant between 9.30 p.m. and 7.30 a.m., suspending it six weeks so that steps could be taken to diminish the noise. Damages of 20 guineas were awarded, with costs.

Notes

The 1933 World Power Conference

The participation of fifteen countries (outside Scandinavia) in the next sectional meeting of the World Power Conference has been assured. More than 170 reports have been announced so far. About forty reports to be published at the meeting deal with problems of energy supply in large-scale industry, such as combined power and heat supply, the rôle of large-scale industry in national power schemes, &c. In these papers are contained some new solutions of important technical and economical problems. Other papers are devoted to more special power problems concerning the iron and steel industry, pulp and paper, as well as cement, sugar, textile and other steam heat-consuming industries. Transport yields subjects for sixty-two reports; railway and marine transport, peculiarities of city and suburban traffic are discussed, with emphasis on the keen competition which electric traction and Diesel engines have put up against the steam locomotive.



A grid tower at Arlingham in the South-West England area. A photograph by Mr. Victor Turl, Bristol

The meeting, which will take place from June 26th to July 10th next year, is designed to provide an opportunity for commercial and industrial men to meet the power expert in order to discuss common problems and exchange experience.

The Garrick Theatre, Southport

There are many novel applications of electricity in the Garrick Theatre, Southport, opened last week—notably the application of light as a decorative medium to the proscenium arch, auditorium and walls, and the method of lighting the ceiling. The central recessed lighting in the roof and the tubular lighting around the walls are particularly striking, while the shape and style of the glass panels under the circle give a very pleasing modernistic effect. The installation was designed and carried out under the supervision of Mr. Basil Davis, the electrical contractors being Messrs. Wm. Tompkinson & Son, Liverpool. The Strand Electric & Engineering Co., Ltd., was responsible for the stage equipment work. Over 3,000 "Osram" lamps, twenty-five miles of "Pirelli-General" wire, and ten miles of "Magnet" conduit tubing for carrying the cables have been installed, the Witton motor generators used being twice the capacity of those usually employed in a theatre of this size, on account of the large number of spot arcs and projectors.

I.E.E. (North-Midland Centre)

An electrical engineers' dance, under the auspices of the North Midland Centre of the I.E.E., will be held on January 27th, at the Grand Hotel, Harrogate. Tickets (inclusive of dinner but not wines, £1 1s. each—student members 15s. each) can be obtained from Mr. W. R. T. Skinner, hon. secretary of the dance committee, 36, Park Place, Leeds, 1. As a result of the dance it is hoped to hand a donation to the Benevolent Fund of the I.E.E.

The E.A.W.

Members of the North-West Midlands branch of the Electrical Association for Women and a number of high school girls were recently addressed by Mr. J. G. Jackson (G.E.C.) on how electric lamps are made. At the same meeting Mr. C. H. Yeaman, city electrical engineer of Stoke-on-Trent, delivered a talk on how electricity is produced and distributed, what it will do in the home, and what its various uses cost as compared with other methods.

Electric Colliery Winders

Mr. E. Loynes, of the Metropolitan-Vickers Electrical Co., Ltd., read a paper on "Some Recent Improvements in Electric Winders" before the West of Scotland Branch of the Association of Mining Electrical Engineers in Glasgow on December 21st. The author said that it was becoming increasingly necessary to wind from greater depths to obtain minerals, so that higher winding speeds were being adopted to obtain the maximum possible output, thus increasing the necessity for installing highly efficient and reliable control and protecfive gear with correctly designed equipment. He illustrated his remarks with lantern slides depicting a variety of electrically operated safety devices and winding appliances, including the Ward-Leonard control gear and the Stubbs-Perry turbo-electric winding system.

Dealing with the protection of hoists, he emphasised the fact that the use of overwind limit switches, or tripping mechanisms, operated by the travelling pointer of the depth indicator, and of a centrifugal overspeed device connected to either the drum or motor shaft was not sufficient protection for high-speed hoists. It was essential to co-ordinate the actions of the overwind and overspeed devices so that the speed governor setting was reduced, as the cage approached the bank, to ensure that, if the retardation was not commenced early enough or the speed as it approached the bank exceeded the safe value, the equipment would be tripped at the point where the limit was exceeded and safely brought to rest.

Most of the apparatus in use for the co-ordination of the overwind and overspeed elements suffered from the disadvantage of not being sufficiently sensitive and accurate for reliable protection. The simplicity and accuracy of a governor was increased by making it as light and sensitive as possible, and, since small switches could be used on electric winders, instead of mechanical latches, it was possible to design a very sensitive and accurate device. Concluding, Mr. Loynes said that a very wide range of apparatus and special applications were now available to meet almost every condition.

A Diesel-electric Ferry

For ferry propulsion the Diesel-electric system has distinct advantages, especially if the vessel be double ended. Some time ago an order for a boat of this class was placed in China with a newly established yard, the South China Motor Ship Building and Repairing Works, whilst the machinery contract was awarded to British firms. The new boat is for the Star Ferry Co. and will operate between Hong Kong and Kowloon. There is a distinct novelty in the arrangement of the machinery as compared with that in other Diesel-electric ships. The *Motor Ship* says that a horizontal eight-cylinder Crossley Premier four-cycle vis-à-vis model designed to develop 500 b.h.p. at 270 r.p.m. drives a 300-kW B.T.-H. dynamo, and current is delivered to two 370-b.h.p. electric motors. Only one of these is in service at a time, dependent upon the direction in which the ship is proceeding. Control is effected wholly from the bridge and overloads on the generator or motors are prevented by a power-limiting arrangement. Direct-current machinery is adopted.

Appointment Vacant

Engineer and manager for Lerwick Corporation.
(See our classified advertisements to-day.)

Electricity for Poultry

A modern poultry hut containing over 30,000 sq. ft. of timber and 1,000 sq. ft. of "Vitaglass" has been erected by Mr. H. Tobias, of Burnley Road, Colne. The hut is over 204 ft. long and 28 ft. wide, and is being illuminated and heated by electricity. It will accommodate over 1,000 hens.

Electrical Mushroom Growing

In Vancouver, B.C., mushrooms are being grown by electricity. The test is being made by the British Columbia Electric Railway Co. on the Dunbar mushroom farm, the largest in Western Canada. The spawning of the mushrooms is being helped by a cable buried in the bed, supplying the heat that is originally provided by the fresh manure. Electrical engineers, pointing to other successes through soil heating, are convinced that the experiment will succeed. The test will be continued until it is found how many crops can be taken from one bed without using new manure. Careful records will be kept of the production volume and the cost of electricity.

Mr. W. Dunbar setting the thermostat of the mushroom growing installation

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

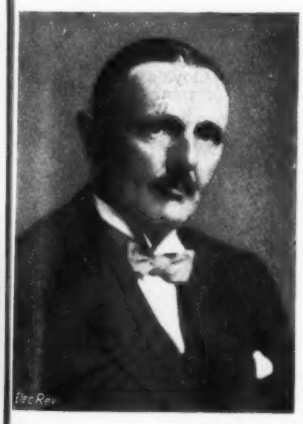
Sir Tom Callender has *not* retired from the managing directorship of Callender's Cable and Construction Co., Ltd. The report published in an evening paper on Tuesday is entirely without foundation.

Mr. Theodor Petersen, M.I.E.E., has been appointed a director of Callender's Share & Investment Trust, Ltd.

In our last issue we mentioned that **Mr. Reginald O. Kapp,** M.I.E.E., was leaving on Friday last with his wife for their honeymoon on the Continent. The wedding took place at Elm Road Baptist Church, Beckenham, Mr. E. W. Record, of the *Birmingham Post*, acting as best man. The accompanying picture shows Mr. Kapp and his wife (*neé* Miss Dorothy M. Wilkins, M.B., B.S.) with a number of friends and colleagues from Messrs. Kennedy & Donkin on the departure platform of Victoria station.

The North Western Whitley Council for the Electricity Supply Industry held its annual meeting on December 29th, and the proceedings were marked by an interesting social event consequent upon the retirement from the trade union side of **Messrs. C. E. Ross** and **D. Williams. Councillor J. Gorman** was elected chairman of the Council for the ensuing year, and **Ald. T. E. Higham** was elected vice-chairman. Messrs. Ross and Williams, together with two other original members, Messrs. R. Blackmore and J. T. Watkins, M.B.E., were guests at a subsequent luncheon, when Ald. Higham, supported by Councillor Gorman and Mr. C. D. Tait, paid tribute to the excellent services rendered by them in the business of the Council since 1919. Mr. A. H. Banks expressed his regret at the severance of the happy association between Mr. Ross and himself as joint secretaries. Ald. Higham then, on behalf of the Council, presented Mr. Ross with a single-stone gold ring and Mr. Williams with a barometer, and expressed on behalf of the members their best wishes for a long and happy retirement.

Mr. and Mrs. R. O. Kapp leaving Victoria for their honeymoon



[*Elliott & Fry*

Col. A. S. Angwin

Col. A. S. Angwin, D.S.O., M.C., who has been appointed Assistant Engineer-in-Chief to the General Post Office, has been engaged in the Engineer-in-Chief's Department Wireless Section since the war, and has been staff engineer-in-charge since June, 1928. The principal wireless works on which he has been engaged have been the Leafield, Cairo, and Rugby stations. He has also been associated with the beam stations which were constructed by the Marconi Co. for the Post Office, and has been engaged in the development of trans-atlantic telephony. He was chairman of the Wireless Section of the Institution of Electrical Engineers for the year 1931-32.

The Birmingham Electric Club.—At the recent annual meeting of the Club the following officers were elected for 1933:—President, Mr. J. M. Dunkley; vice-presidents, Messrs. J. Parkinson and J. H. Asdell; treasurer, Mr. G. Rogers; social secretary, Mr. W. E. Clark; secretary, Mr. A. M. Fletcher.

Mr. F. W. Purse, M.I.E.E., has been engaged by Margate Town Council to advise on engineering matters arising on a report as to electricity charges in the borough.

Mr. R. A. Bachman, managing director of Britannia Batteries, Ltd., was recently presented by the company's Recreation and Social Club with a silver cigarette case as a token of appreciation of his many acts of liberality.

Mr. A. Stuart Roger has been appointed a director of the Telephone & General Trust, Ltd.

Mr. S. F. Wheeler has been appointed resident service engineer in Belfast by the Marconiphone Co., Ltd.

Miss Gladys Clayton, of Chesham, commences duty next Monday as demonstrator at the Aylesbury Corporation electricity showrooms in place of **Miss Ainsworth,** who recently left for Bedford. **Miss Eileen Turnbull,** who has acted temporarily in Miss Ainsworth's absence, was on Friday last presented with a manicure set, the presentation being made by Mr. Logan, sales superintendent.

Sir Philip A. M. Nash has joined the reconstituted board of the Great Universal Stores, Ltd., and has been appointed chairman.

It is reported in the daily Press that the Court of Appeal at Athens on December 27th gave a verdict against the extradition of **Mr. Samuel Insull** to the United States.

Mr. H. F. Russell, manager in England of the Commercial Cable Co., is retiring to-morrow (Saturday), and will be succeeded by **Mr. James Milne,** formerly superintendent of the All-America Cables, Inc., at Buenos Aires.

Mr. O. G. Cook, electrical engineer and manager of the Bingley Urban District Council's electricity undertaking, has been granted an increase in salary.

Mr. T. H. Redfern, a director of Redfern's Rubber Works, Ltd., has been appointed chairman of the National Union of Manufacturers (Manchester Branch) for 1933.

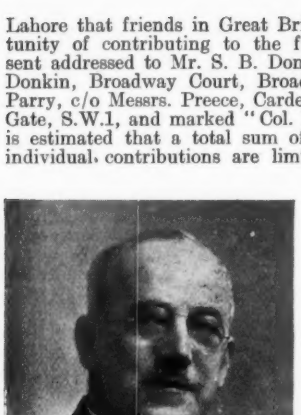
Mr. E. T. Goslin, general manager of the Clyde Valley Electrical Power Co., has intimated to the directors his wish, for health reasons, to retire from the service of the company at the close of the current year. Mr. Goslin has held the position of general manager of the Clyde Valley Company since 1920. For twenty years previous to that he was in the service of the Glasgow Corporation Tramways Department, and was chief electrical engineer for eighteen years. A native of Ramsgate, Mr. Goslin began his career in London with Messrs. Crompton & Co., Ltd., and filled other positions in England before joining the staff of the Glasgow Corporation. During the War he assisted the Coal Controller and was afterwards appointed to the Ministry of National Service as Deputy Director of Labour. He held the rank of major in the City of Glasgow Royal Engineers and acted as O.C. In July this year he was invited by the Central Electricity Board to serve on the Technical Consultative Committee for Scotland.

[*Weir, Glasgow*

Mr. E. T. Goslin

A memorial fund has been opened in Lahore, Punjab, for procuring a bronze tablet to the memory of the late **Col. B. C. Battye,** D.S.O., R.E., chief engineer of the Punjab Hydro-Electric Undertaking. The tablet is to be erected in the power house at Shanan, which is now approaching completion. It has been suggested by members of the Memorial Fund Committee in

Lahore that friends in Great Britain will welcome an opportunity of contributing to the fund. Contributions may be sent addressed to Mr. S. B. Donkin, c/o Messrs. Kennedy & Donkin, Broadway Court, Broadway, S.W.1, or to Mr. E. Parry, c/o Messrs. Preece, Cardew & Rider, 8, Queen Anne's Gate, S.W.1, and marked "Col. Battye Memorial Fund." It is estimated that a total sum of £200 has to be raised and individual contributions are limited to £1.



[*Lafayette*

Sir Holberry Mensforth

Sir Holberry Mensforth has been elected a director of Edmundson's Electricity Corporation, Ltd., and of the Shropshire, Worcestershire, and Staffordshire Electric Power Co., and has been appointed chairman of these companies. In order to enable him to devote the necessary time to his new activities, Sir Holberry Mensforth will resign the chairmanship of the English Electric Co., Ltd., but will remain on the board. He joined the British Westinghouse Co. (now Metropolitan-Vickers Electrical Co., Ltd.) in 1904, and subsequently became general manager. He was appointed chairman of the English Electric Co., Ltd., in 1930. Sir Holberry is a K.C.B., C.B.E., and M.Sc., and is a member of the Institutions of Civil and Mechanical Engineers.

Sir Bernard Greenwell has resigned the chairmanship of Edmundson's Electricity Corporation and associated companies, and **Messrs. A. W. Bolden** and **A. G. Hunt**, who joined these boards with him, have also resigned.

[*A. Winter, Preston*

Mr. R. Livingstone

Mr. Robert Livingstone, the author of the article on "Feed-water Heating" on page 952 of this issue, has held important positions at the Dick, Kerr Works, Preston, including that of manager of the group comprising electrical car building, and lamp works. He has investigated power station design in America and other countries, and has recently completed tests and reported upon the operating efficiency of one of the modern power stations in Lancashire. He is now in private practice.

In celebration of the fortieth anniversary of our Italian contemporary, *Elettricista*, it is proposed to hold a banquet in Rome, at which **Professor Angelo Banti**, the founder of the journal, will be presented with a gold medal. Professor Banti was one of the foremost pioneers of electricity in Italy and was instrumental in bringing electric lighting to Rome.

Obituary

Mr. J. Sayers.—The death is announced of Mr. James E. Sayers, M.I.E.E., of Messrs. James E. Sayers & Co., consulting engineers, West George Street, Glasgow, which took place at his residence, Struan, Clarkston, on Christmas Day. For many years he acted as secretary of the Scottish Centre of the Institution of Electrical Engineers and was held in the highest esteem in the business community. An engineer of great experience and ability, he was consulted by many corporations and companies regarding important schemes throughout the country.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Piccadilly Radio Co., Ltd.—Private company. Registered December 17th. Capital, £100 in £1 shares. Objects: To carry on the business of radio dealers, suppliers of electrical goods, &c. The directors are: M. A. Davis, 216, Clapham Road, S.W.9, and W. Cope, 8, Green Street, E. Registered office: 27, Coventry Street, W.1.

Modern Electrical Installation & Maintenance Co., Ltd.—Private company. Registered December 2nd. Capital, £100 in 1s. shares. Objects: To carry on the business of electricians, mechanical engineers and manufacturers and workers of and dealers in electricity. H. F. Bowers, 95, Hopton Road, S.W.16, is the first director. Solicitors: Underwood Piper & Heys-Jones, 12/13, Holles Street, W.1.

A. L. Turner, Ltd.—Private company. Registered December 15th. Capital, £100 in £1 shares. Objects: To acquire the business of wireless and electrical engineer, carried on by A. Turner at 20, Cooper Street, Withington, Manchester. The directors are: A. Turner and Mrs. E. Davies, both of 20, Cooper Street, Withington. Secretary: G. T. West. Registered office: 20, Cooper Street, Withington.

Compton Radio Wholesalers, Ltd.—Private company. Registered December 19th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and wholesale and retail dealers in wireless apparatus, gramophones and accessories, electrical, mechanical and other apparatus, &c. The subscribers are: G. R. Waygood and B. Biggs, both of Abbey House, Westminster, S.W.1. Secretary: G. R. Waygood. Registered office: 56, Old Compton Street, W.1.

Wright & Horsley, Ltd.—Private company. Registered December 19th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in all kinds of wireless apparatus, &c. The directors are: F. N. Wright, Hill House, Lydney, Glos, and two others. Secretary: H. Horsley. Registered office: Hill Street, Lydney, Glos.

Lionel Hart, Ltd.—Private company. Registered December 19th. Capital £3,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in accumulators and batteries, wireless sets, aerials and cabinets; electricians, radio and electrical engineers, &c. The permanent directors are: H. L. Hart, 47, Sparkenhoe Street, Leicester, and A. Finburgh, Grand Hotel, Leicester. Registered office: 47, Sparkenhoe Street, Leicester.

Neon Crafts, Ltd.—Private company. Registered December 22nd. Capital £700 in £1 shares (500 redeemable 5 per cent. cumulative preference and 200 ordinary). Objects: To carry on the business of manufacturers of and dealers in advertising devices known as "Neon Signs," &c. To acquire from L. H. Perrett the business and assets referred to in an agreement, &c. The subscribers are: A. W. Booth, 39, Sundridge Road, Addiscombe, Surrey, and P. C. Smith, Lloyd's Building, E.C. The first directors are: L. H. Perrett (permanent) and T. W. Jubb. Registered office: 62, Oxford Street, W.1.

British Glowlamp Works, Ltd.—Private company. Registered December 22nd. Capital £100 in 1s. shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electric lamps, fuses, lamp cabinets, fuse cabinets, advertising, illuminated bowl and electric flashing signs, &c. The first directors are: S. P. Rety and O. W. Songest. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, Strand, W.C.2.

White Metals, Ltd.—Private company. Registered December 22nd. Capital £30,000 in £1 shares. Objects: To acquire that portion of the business carried on at Watford of Grosvenor Electric Batteries, Ltd., pertaining to the manufacture of zinc containers, &c. The directors are: W. G. Adie, "Tintern," Great Nelmes, Hornchurch; A. Kirkeback, 32, Kingswood Road, Goodmayes; H. C. Dunell Ryarch Place, W. Malling; and L. S. M. Wells, Mount Arlington, Shortlands, Kent. Registered office: 304b, High Street, Watford.

Brand Electrical and Engineering Co., Ltd.—Private company. Registered December 20th. Capital £1,000 in £1 shares. Objects: To carry on the business of electrical engineers and general electrical installation contractors, &c. The directors are: H. E. Brand, "Ramillies," 16, St. Julians Road, Newport, Mon; and J. L. Leake, The Mount, Bassaleg, Mon.

Returns of Electrical Companies

A. W. Griffin & Co., Ltd.—F. H. Pickering, 33, Newhall Street, Birmingham 3, ceased to act as receiver and manager on December 12th.

North-Eastern Electric Supply Co., Ltd.—Satisfaction to the extent of £330,000 (being full amount due) on October 18th, 1932, of mortgage dated July 31st, 1919, and registered October 28th, 1919.

Concordia Electric Safety Lamp Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 21st, 1932, to secure all moneys due or to become due from the company to Barclays Bank Ltd.

Brentwood District Electric Installations, Ltd.—Capital, £1,000 in 1s. shares. Return dated May 31st (filed October 4th), 1932. All shares taken up. £1,000 paid. Mortgages and charges: £4,500.

Rooke Bros., Ltd.—Capital, £5,000 in £1 shares. Return dated September 12th, 1932. All shares taken up. £2,000 paid. £3,000 considered as paid. Mortgages and charges: £1,800.

Terrystone Radio Products Co., Ltd.—E. W. Bales, 24, Busby Place, N.W.5, was appointed receiver and manager on December 3rd, under powers contained in mortgage debenture dated October 31st, 1932.

Wortex Manufacturing Co., Ltd.—E. Bessunger, 20, Wellington House, Greystoke Road, W.5, ceased to act as receiver and manager on April 7th, 1932 (notice filed December 12th).

Siemens Brothers & Co., Ltd.—Capital, £3,000,000 in 550,000 10 per cent. cumulative preference and 2,450,000 ordinary shares of £1. Return dated June 10th, 1932. All shares taken up. £3,000,000 paid. Mortgages and charges: £615,000.

Lewes & District Electric Supply Co., Ltd.—Capital, £50,000 in 1,250 preference and 3,750 ordinary shares of £10 each. Return dated May 12th, 1932. 3,750 ordinary shares taken up. £37,500 paid. Mortgages and charges: £20,000.

Direct Spanish Telegraph Co., Ltd.—Capital, £95,000 in 13,000 ordinary and 6,000 preference shares of £5 each. Return dated August 5th, 1932. 12,931 ordinary and 6,000 preference shares taken up. £94,655 paid. Mortgages and charges: £92,000 4½ per cent. debentures.

Watson & Henderson, Ltd.—The nominal capital has been increased by the addition of £5,000 in £1 shares beyond the registered capital of £5,000.

Christy Brothers & Co., Ltd.—The nominal capital has been increased by the addition of £10,000 beyond the registered capital of £115,000. The additional capital is divided into 10,000 6 per cent. cumulative preference shares of £1 each.

Wireless Services, Ltd.—Issue on November 14th of £2,000, and on December 1st, 1932, of £500 debentures, parts of a series already registered.

E. C. & A. Ferguson, Ltd.—Particulars filed of £1,500 debentures, authorised December 12th, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Claude-General Neon Lights, Ltd.—Particulars filed of £50,000 debentures, authorised August 30th, 1932, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £6,500.

Burford Electric Light & Power Co., Ltd.—Particulars filed of £6,000 debentures, authorised December 7th, charged on company's undertaking and property, present and future, including uncalled capital and book debts, the whole amount being now issued.

Dawlish Electric Light & Power Co., Ltd.—The nominal capital has been increased by the addition of £10,000 in £1 ordinary shares beyond the registered capital of £30,000.

Oriental Telephone & Electric Co., Ltd.—Satisfaction to the extent of £1,900 on December 13th, 1932, of debenture stock secured by trust deed dated June 28th, 1905, and supplemental deed of acknowledgment dated June 12th, 1907, and registered July 11th, 1905, and June 20th, 1907, respectively.

Gem Labor Saving Device Co., Ltd.—Deposit dated December 10th, collaterally securing all moneys due or owing by the company to Associated Distributors, Ltd., Vernon House, Friar Lane, Nottingham. Property charged: All property, money and advantages comprised in, secured or represented by or derivable under a debenture dated July 17th, 1929, and an assignment, &c.

Correction.—In our issue of December 16th the name of Ecco Radio, Ltd., was incorrectly printed as Ekco Radio, Ltd.

City Notes

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., held its annual meeting on December 21st, Mr. B. H. Binder (chairman) presiding. Before proceeding to deal with the accounts (ELEC. REV., December 16th, p. 909), the chairman referred to the loss to the company through the deaths of the chairman, Sir John Ferguson, and Mr. C. H. Gray, joint managing director. He said that he was invited by the directors in October last, with the concurrence of some of the larger shareholders, to join the board and accept the position of chairman. After visiting the company's works at Persan and Silvertown he accepted their invitation in the hope that he might, with their co-operation, be able to help in carrying out the programme already inaugurated of progressive methods combined with economy, with the object of bringing back the company to a profit-earning basis. The task was not an easy one; competition was keen and times were bad, but the company's products had a good name for quality. Perhaps the secret of the lack of success in the last few years was that the company had lived too long on its past reputation and had been slower than others in adopting modern methods in various ways. It was now adopting them, but changes in a big business took time. The trying period of transition was reflected in the accounts, which had been further adversely affected by the difficulties arising from the general depression and severe competition. As indicated by his predecessor at last year's meeting, proposals for a scheme of reorganisation, including the writing down of certain items in the balance sheet, would be submitted in due time to shareholders, but it would be advisable for this step to be deferred until the general outlook was less uncertain and a profit was again in sight. Such a scheme must deal not only with the value of the fixed assets but also with the debit balance on the profit and loss account and the balance on the reconstruction suspense account. The transfer from Burton to Silvertown was completed during the first half of the financial year. While this work was carried out with the minimum of disturbance to the other sections of the Silvertown factory, it caused certain unavoidable delays which had some adverse influence on the result for the year. In addition, the training of new hands for the processes transferred from Burton to Silvertown involved time and expense. Certain key men were brought to Silvertown, but in general it was necessary to train new labour, and the cost of production in consequence suffered while this was taking place. Competition in both home and foreign markets had increased in intensity during the year, and it had been admitted in the industry that the market prices of certain rubber products had been unremunerative. Steps had recently been taken to alleviate the situation. Their sales of goods classified as general rubber products were fully maintained throughout the period. Referring to his visit to Persan, Mr. Binder said he went there with the preconceived idea that it should be closed down, but the information given him on the spot caused him to change his views. The facts demonstrated to him—and these applied to some extent also to Silvertown—were that the difficulties and losses had been accentuated because the factory could not produce quickly enough to meet all the sales that could be made. That was a question of organisation, and the returns received for the first period of the new financial year indicated that progress was now being made at Persan towards increased production at lower cost.

John Shaw & Sons, Wolverhampton, Ltd., report a net loss for the year ended June 30th of £6,507, as compared with £22,244 in the preceding year, and, after deducting £3,532 brought in, the debit carried forward is £2,974. Mr. H. Guedalla resigned from the board during the year, and Mr. M. S. Myers was elected a director, without remuneration, but resigned on December 10th. He will, however, continue to assist the board. Mr. G. Ewart has been elected to the board without remuneration, and Messrs. H. Treble and R. Terrell were also elected directors.

The United Electric Tramways Co. of Caracas reports that after paying interest on the first and second debentures there is a loss for the year ended June 30th of £952, which, deducted from £64,223 brought forward, leaves a credit at profit and loss account of £63,270. Loan interest chargeable to the local tramways company for the year amounted to £5,238, but that company has remitted only £1,075. This sum only has been credited in the accounts, and the balance of £4,162 has been carried to a reserve.

Brazilian Traction Light & Power Co.—The gross earnings for the first eleven months of 1932 were $27,127,000, as compared with $32,475,000 for the corresponding period last year. The net earnings for the eleven months were $15,611,000, against $19,562,000.—*Reuter* (Toronto).

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—Hightensite & Ebonite Manufacturing Co., Ltd.; Orford Electric Light & Power Co., Ltd.

Telephone Rentals, Ltd., has announced an interim dividend of 2½ per cent.

Stocks and Shares

TUESDAY EVENING.

THE year which is now closing will stand out in the history of the country as being that in which the greatest financial operation in the world's history, up to the present time, had been accomplished. The conversion of 2,000 million pounds 5 per cent. War Loan into a 3½ per cent. stock, carried out with a degree of success which can only be described as amazing, will long serve as a landmark. The War Loan conversion produced an effect upon stocks and shares comparable in extent to that which the departure of this country from the gold standard in September, 1931, exercised over prices of all kinds. Whereas the latter operation sent investment prices down, the conversion of the War Loan had a precisely opposite effect. A year ago, when writing at this time, there were, in practically every group dealt with, substantial falls to be recorded. It was a distasteful and melancholy business to review the financial effects of the year's working. Happily, the pendulum has swung during 1932 in the opposite direction, and, apart from the departments swayed by American influences, nearly all the markets stand out with greater or less appreciation to the credit of their stocks.

London's Electricity Supply

This year is the first under which the London Electricity Supply Companies come under the scheme whereby the standard rate of dividend on their ordinary shares is fixed at 7 per cent., unless it should happen that the companies are able to make reductions in their customers' charges in such manner as will enable the payment of an increase upon the 7 per cent. standard rate. No little curiosity awaits the outcome of this first year's working under the new plan, but anticipation takes the cautious view that the companies will, at any rate for this year, adhere to the 7 per cent. dividend. The prices of the ordinary shares have moved up to a fairly common level of 33s. 6d., the only exceptions in the following group being County of London and Metropolitan. The falls of a year ago have been more than regained, and to-day's prices represent practically the highest levels to which the shares have attained for many years.

Ordinary Shares.	Dec. 30th, 1930.	Dec. 30th, 1931.	Now.	Rise or Fall.
Brompton	27/6	27/6	33/6	+ 6/-
Charing Cross	29/-	29/-	33/6	+ 4/6
Chelsea	27/6	26/-	33/-	+ 7/-
City of London	36/3	35/-	34/-	— 1/-
County of London	47/6	43/3	50/-	+ 6/9
Kensington	27/6	29/-	33/6	+ 4/6
Metropolitan	42/-	37/6	47/-	+ 9/6
St. James' and Pall Mall ...	28/-	29/-	33/6	+ 4/6
South London	27/-	25/6	33/-	+ 7/6
Westminster	29/-	28/-	33/-	+ 5/-

The scarcity of supply in the shares of the London electricity companies, and the impression that the dividends on these shares would be limited for a time to 7 per cent., has had the natural effect of diverting attention to the shares in the Scottish and provincial supply undertakings. These latter stand

in rather a different class from those of the London concerns, in that most of them are concerned with large areas of supply, and the possibility of expansion is always present to the mind of the shareholder, who likes to get an occasional bonus in the shape of fresh shares at less than the market price.

It will be noticed that the trend has been upward in the Provincial group, as with the shares of the London companies. The figures at the end of December, 1930, are given below, but so many changes have occurred in capital accounts that the comparisons are of academic interest only.

Ordinary Shares.	Dec. 30th, 1930.	Dec. 30th, 1931.	Now.	Rise or Fall.
Bournemouth and Poole ...	3 3/8	2 7/8	70/6	+13/-
Clyde Valley	35/-	30/9	32/-	+ 1/3
Elec. Dis. Yorkshire ...	37/-	33/-	41/3	+ 8/3
Lancs. Light and Power ...	25/-	24/6	29/3	+ 4/9
Midland Counties	28/6	26/3	33/3	+ 7/-
Mid. Elec. Power	31/3	28/9	34/6	+ 5/9
Newcastle-on-Tyne	25/9	23/3	28/-	+ 4/9
Northampton...	45/9	40/3	48/9	+ 8/6
Scottish Power	29/6	27/-	33/9	+ 6/9
Yorkshire Elec.	35/-	31/3	39/-	+ 7/9

Tube Railway Fortunes

The principal feature of the year's working, as it relates to Home Railway stocks in the Underground combine, lies in the improvements recorded by the prior-charge securities of the various companies. Owing to the rise in War Loan and other British Government stocks, the Safety First issues of the electric railway companies have gone steadily ahead, affected more by money considerations than by those which concern the passing of the London Passenger Transport Bill, upon whose fortunes the ordinary stocks of the companies have depended. The Bill has been postponed until the forthcoming session of Parliament, which opens on February 7th. Sporadic opposition has been offered during the year now ending, but it is assumed that the hostility can now be regarded as practically finished, and that the Bill will go through without any great alteration from its present form. Metropolitan consolidated has risen 25½ points, because of the excellent bargain which the board struck in connection with the coming into the transport group. Districts have gone up but little. Central London ordinary stock is 14 points to the good, in sympathy with the strength shown by fixed interest stocks as a whole. Underground ordinary are unchanged.

Stock or Shares.	Dec. 30th, 1930.	Dec. 30th, 1931.	Now.	Rise or Fall.
Central London	79	68½	82½	+ 14
Metropolitan	68½	35½	61	+ 25½
Metropolitan District ...	77	60½	62½	+ 2
Underground	24/6	19/-	19/-	—

Cable Improvements

The year has seen dramatic fluctuations in Cables & Wireless stocks. These have followed upon rumours probable and improbable, but the partial clearing-off of dividend arrears from the preference stock made tangible evidence of better business conditions for the combine. This enabled the Globe Telegraph & Trust ordinary shares to return to the dividend list. The group of British telegraph and telephone issues shows improvement; Marconi Marines, exceptionally, have given way to a slight extent.

Stock or Shares.	Dec. 30th, 1930.	Dec. 30th, 1931.	Now.	Rise or Fall.
American Tel. and Tel. ...	182½	175	155½	− 19½
Anglo-American pref. ...	103½	92½	106½	+ 14
Cables and Wireless pref. ...	70	47½	77½	+ 30
Cables and Wireless "A" ...	22½	17	27	+ 10
Cables and Wireless "B" ...	11½	10	12	+ 2
Globe ordinary	13	8	10¾	+ 2¾
Great Northern	30	20½	27½	+ 7
International Tel. and Tel....	20½	12	11	− 1
Marconi Marine	38/9	33/3	32/-	− 1/3

Manufacturing and Equipment

The unpleasant spot in the market for manufacturing and equipment issues is a drop of 35 points in Brush. The stock is now quoted at 35 as compared with 70 this time last year and 105 at the end of 1930. Other prices are mostly better in this market. Henley's secured the chief advance, but British Insulated, Callender's, and Enfields are also well up, as this representative list illustrates:—

Ordinary Shares.	Dec. 30th, 1930.	Dec. 30th, 1931.	Now.	Rise or Fall.
Babcock	49/6	46/3	40/-	− 6/3
British Aluminium	30/6	23/9	23/9	—
British Insulated	3⅜	2⅝	3½	+12/6
Brush	105	70	35	− 35
Callender's	3½	2½	3½	+12/6
Enfield Cables	4 1/16	3⅛	4 1/16	+11/3
G.E.C.	2 3/16	42/-	38/9	− 3/3
Henley's	5½	4 11/16	6 1/16	+ 1⅛
India Rubber...	6/3	6/3	2/6	− 3/9
Johnson and Phillips ...	36/9	23/9	1	− 3/9
Siemens	21/3	20/-	25/-	+ 5/-

Looking Ahead

Of what the coming New Year holds in the shape of financial fortune to companies engaged in the electrical world, these days may be too early in which to prophesy except in approximate fashion. The use of electricity must tend inevitably to increase. Trade depression may impose a check upon normal expansion and expenditure, but this is no more than a transient factor. Speaking purely financially, investment is on the keen look-out for first-rate industrial shares which give a higher yield than British Government and trustee securities. No doubt is entertained as to the likelihood of money-rates becoming stiffer as industry returns to trade channels, but such a change-over will come gradually.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1930.	1931.	Price, Dec. 28.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	70/6	—	4 4 9
Brompton Ordinary	1	8½	8½	33/6	—	4 3 7
Central Electricity 4½% Deb. ...	Stock	4½	4½	104	—	4 5 9
Charing Cross Ordinary	1	8½	8½	33/6	—	4 3 7
Chelsea	1	8½	8⅞	33/-	−6d.	4 4 10
City of London	1	10	10	34/-xr.	—	4 2 4
Clyde Valley	1	8	7	32/-	—	4 7 9
County of London	1	11	10½	50/-	—	4 4 0
Edmundsons' 7% Pref.	1	7	7	30/-	—	4 13 4
Elec. Dis. Yorkshire	1	9	9	41/3	—	4 7 4
Elec. Supply Corporation	1	11	11	57/6	+½	3 16 6
Kensington Ordinary	1	8	8	33/6	—	4 3 7
Lancs. Light and Power	1	6½	7	29/3	—	4 15 9
London & Home Counties 4½% Deb.	Stock	4½	4½	107	—	4 4 0
London Electric	1	9	9	33/6	—	4 3 0
Metropolitan	1	10	10	47/-	+9d.	4 5 1
Midland Counties	1	7	7	33/3	—	4 4 2
Mid. Elec. Power	1	8	8	34/6	—	4 12 9
North Eastern Electric Ordinary...	1	6	6	28/-	—	4 5 9
Do. 7% Pref.	1	7	7	31/6	—	4 9 0
Northampton	1	10	10	48/9	—	4 2 0
Notting Hill 6% Pref.	10	6	6	12¾	—	4 14 0
North Met. Elec. 6% Pref. ...	1	6	6	29/-	—	4 2 9
St. James' and Pall Mall	1	8	8	33/6	—	4 3 7
Scottish Power	1	8	8	33/9	—	4 14 10
South London	1	8½	8½	33/-	—	4 4 10
Urban Ordinary	1	7	7	33/9	—	4 3 3
Westminster Ordinary	1	8½	8½	33/-	—	4 4 10
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	16/3	—	9 4 9
Yorkshire Elec.	1	8	8	39/-	—	4 2 0
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	82½	—	4 17 0
Metropolitan	,,	3½	2½	61	—	4 2 0
Do. District	,,	5	4½	62½	—	7 4 0
Underground Electric	1	8	7	19/-	—	7 7 4
TELEGRAPH AND TELEPHONES.						
American Tel. & Tel.	$100	9	9	155½	—10	5 15 10
Anglo-Am. Tel. Pref.	Stock	6	6	106½	—	5 12 9
Do. Def.	,,	1½	1½	26	—	5 15 5
Cables & Wireless 5½% Pref. ...	,,	5½	2¾	77½	—1	3 11 0
Do. A 7½% Ord.	,,	—	Nil	27	—1	—
Do. B Ord.	,,	—	Nil	12	—	—
Globe Tel. and T. Ord.	10	8½	Nil	10¾	—	—
Do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	20	20	27½	—	7 5 6
Marconi-Marine	1	15	10	32/-	—	6 5 0
Oriental Telephone Ord.	1	12	12	2 11/16	—	*4 1 8
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	—	—	3/3	—	
Do. do. 2nd Pref.	5	—	—	3/9	—	—
Do. do. 5% Deb.	Stock	—	—	7	—	
British Electric Traction Def. Ord.	,,	5	5	265	—	—
Do. do. Pref. Ord.... ...	,,	8	8	132½	—	6 0 0
Brazil Traction	100	—	—	12½	+⅜	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	101½	—	4 18 6
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/6	—6d.	—
London United Tram Deb. ...	Stock	4	4	65½	—	6 2 2
Mexico Trams, 5% Bonds... ...	—	5	5	47/½	+2½	10 10 6
Mexican Light Common	100	Nil	Nil	10	—	—
Do. 7% Pref.	100	7	7	15	—	—
Do. 1st Bonds	—	5	5	70	—2½	7 2 10
Victoria Falls Ord.	1	15	15	78/8	+ 1/16	3 17 4
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	—
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	6	4	17/6	—	4 11 5
Do. Pref.	1	8	8	30/9	+9d.	5 4 1
Babcock & Wilcox	1	14	14	2/-	+ 1/16	—
British Aluminium Ord.	1	10	5	23/9	—	4 4 0
British Insulated Ord.	1	15	15	65/-	—	4 12 4
Brush Ord.	Stock	5	Nil	35	—	—
Callender's	1	15	15	3½	—	4 16 0
Do. 6½% Pref.	1	6½	6½	28/3	—	4 12 0
Crompton Parkinson Ord.... ...	5/-	30	24	20/9	—	5 8 0
Do. 8% Pref.	1	8	8	30/-	—	5 6 8
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	100	+2	5 0 0
Electric Construction	1	Nil	Nil	8/9	—	—
Enfield Cable Ord.	1	25	25	4 7/16	—	5 12 7
English Electric	1	Nil	Nil	10/-	+6d	—
Do. do. Pref.	1	Nil	Nil	15/-	— 1/16	—
Ever Ready	5/-	35	35	27/9	+9d.	6 6 1
Ferranti Pref.	1	7	7	21/6	+6d.	5 14 3
G.E.C. Pref....	1	6½	6½	29/-	—	4 9 0
Do. ord....	1	10	8	38/9	—9d	4 2 6
Henley's	1	30	30	6 1/16	—	4 19 0
Do. 4½ Pref.	5	4½	4½	5½	—	4 5 0
India-Rubber	1	Nil	Nil	2/6	—	—
Johnson & Phillips	1	10	5	1	—	5 0 0
Siemens Ord.	1	7½	7½	25/-	—	6 0 0
Telegraph Construction	£1	Nil	Nil	16/3	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1931

6536. "Electrical switches of the tumbler type." J. A. Crabtree. March 3rd, 1931. (Cognate application 6537/31.) (384323.)

13082. "Infra-red heat and ultra-short wireless wave signalling apparatus." T. M. Hawker. May 4th, 1931. (384325.)

15442. "Mechanism for interconverting electrical and acoustic vibrations such as loudspeakers." J. H. W. Lewis. May 26th, 1931. (Cognate application 17937/31.) (384315.)

15523. "Protective apparatus for electric circuits." British Thomson-Houston Co., Ltd. May 27th, 1930. (384331.)

18071. "Methods of synchronisation in television and like systems." W. W. Jacomb, and Baird Television, Ltd. June 22nd, 1931. (384346.)

20273. "Method of producing metal vapour in vacuum or gas-filled discharge tubes." Radioakt.-Ges. D. S. Loewe. July 17th, 1930. (384351.)

21506. "Radio-gramophone cabinets." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. October 3rd, 1930. (384354.)

23346. "Thermostatically controlled electric switches." W. W. Triggs (Hart Manufacturing Co.). August 19th, 1931. (384357.)

23388. "Sparking plugs, and process of manufacturing same." E. Excoffier. August 22nd, 1930. (384358.)

23467. "Electric generating plant in which the prime mover is a fuel-injection engine." R. A. Lister & Co., Ltd., and W. M. Harrison. August 20th, 1931. (384360.)

23570. "Textile coverings for electric cables and like bodies." F. Meiwald. August 21st, 1931. (384361.)

23717. "Method of using light-activated e.m.f. cells for the measurement and technical uses of light effects. E. Falkenthal. August 26th, 1930. (384362.)

25431. "Multi-range current-measuring apparatus." Siemens & Halske Akt.-Ges. November 8th, 1930. (384376.)

26340. "Electric heating elements, and the manufacture of the same." J. L. Musgrave, L. J. Fowler, and Crittall & Co., Ltd. September 21st, 1931. (384382.)

26498. "Electric switches with arc extinction by self-generated vapour." Siemens-Schuckertwerke Akt.-Ges. October 20th, 1930. (Addition to 25889/31.) (384384.)

26807. "Electric fire igniting devices." W. Schottky. September 26th, 1930. (384387.)

29414. "Illuminating apparatus for the buccal cavity. E. Fischer. October 23rd, 1931. (384402.)

29676. "Electric mercury switch." J. Schneider. November 1st, 1930. (384404.)

30031. "Dynamo-electric machines for high potential. Siemens Schuckertwerke Akt.-Ges. November 1st, 1930. (Patent of addition not granted.) (384407.)

30191. "Process and apparatus for treating electric light bulbs for light distribution." W. F. Chambers. October 31st, 1931. (384409.)

32350. "Piezo-electric oscillators." E. Blackburn. November 23rd, 1931. (384421.)

33270. "Control mechanisms for electrically propelled road and rail vehicles." J. G. Smithson. December 1st, 1931. (384433.)

33699. "Electric control of furnaces." J. T. Millar, C. W. Thompson, and J. E. O'Breen. December 4th, 1931. (384437.)

34127. "Electric clocks." Smith & Sons (Motor Accessories), Ltd., and P. O. Dorer. December 9th, 1931. (Addition to 12033/31.) (384441.)

34445. "Measurement of electrical quantities." Naamlooze Vennootschap Instrumentfabrieken Handel v.h. P.J. Kipp en Zonen. December 11th, 1930. (384443.)

34572. "High tension direct current electric generators." English Electric Co., Ltd., J. E. Calverley, and W. Donnelly. December 14th, 1931. (384446.)

36006. "Electric cables." British Thomson-Houston Co., Ltd. December 30th, 1930. (384456.)

1932

1509. "Television apparatus." L. Koeppe. January 18th, 1932. (384463.)

2868. "Radio receivers." Marconi's Wireless Telegraph Co., Ltd. February 21st, 1932. (384470.)

5150. "Sound reproducing devices of the electrodynamic or moving-coil type." L. W. Murkham and D. T. Bennett. February 20th, 1932. (Cognate application 7987/32.) (384485.)

6085. "Method and apparatus for side band limitation of modulated oscillations." W. Ditsche. February 29th, 1932. (384492.)

7200. "Electric expansion switches." Siemens-Schuckertwerke Akt.-Ges. May 29th, 1931. (384505.)

8303. "Portable electric grinding, drilling, and like machines." R. Bosch Akt.-Ges. July 27th, 1931. (384511.)

8763. "Galvanic batteries." E. D. Carden. March 24th, 1932. (384515.)

10479. "Electric cooking apparatus." British Thomson-Houston Co., Ltd. April 13th, 1931. (384527.)

10601. "Switchgear for electric transformers." B. Jansen. April 13th, 1932. (384528.)

11967. "Dynamo-electric machines." Siemens-Schuckertwerke Akt.-Ges. April 28th, 1931. (384539.)

12397. "Apparatus for the vaporisation electrically of liquids." G. Kilchhofer. April 29th, 1932. (384540.)

12930. "Radio receiving apparatus." Hazeltine Corporation. July 7th, 1931. (384544.)

13416. "Electrodes of alkaline type electric accumulators." Ionic Alkaline Batteries, Ltd., and C. J. Berg. May 10th, 1932. (384546.)

13599. "Condensing systems." Westinghouse Electric & Manufacturing Co. June 19th, 1931. (384550.)

13715. "Luminous electric discharge tubes." General Electric Co., Ltd. June 24th, 1931. (384555.)

14072. "Electrolytic condensers." Telephon-apparat-fabrik E. Zwietusch & Co., Ges. June 23rd, 1931. (384559.)

14947. "Electrodeposition apparatus for the recovery of silver from solutions containing silver salts." Kodak, Ltd. May 28th, 1931. (384564.)

15314. "Electrically stunning animals for slaughter." Reiniger, Gebbert & Schall Akt.-Ges. May 30th, 1931. (384565.)

15553. "Starting arrangement for alternating current electric motors." British Thomson-Houston Co., Ltd. June 1st, 1931. (384567.)

17304. "Superheterodyne receivers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 25th, 1931. (384583.)

18138. "Superheterodyne wireless receivers." O. Wullenweber. June 27th, 1932. (Addition to 29016/31.) (384591.)

18636. "Overload electric switches." W. Leyhausen. July 1st, 1932. (384597.)

18642. "Ornaments adapted for electric treatment of organisms." K. L. J. Meyer. July 1st, 1932. (384598.)

19684. "Toggle operating mechanism for electrical switchgear." English Electric Co., Ltd., and A. A. Heath. July 12th, 1932. (384604.)

20347. "Driving means for electromagnetic loudspeakers." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. August 11th, 1931. (384610.)

20656. "Ventilation of dynamo-electric machines." English Electric Co., Ltd., and F. A. Youngmark. July 21st, 1932. (384611.)

22448. "Electrolytic condensers." Elektrizitäts Akt.-Ges. Hydrawerk. August 11th, 1931. (384617.)

24534. "Electric flat iron." H. Schneider-Clerc. September 3rd, 1931. (384624.)

25476. "Luminous electric discharge tubes." General Electric Co., Ltd. September 16th, 1931. (384626.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 21st :—

C.A.V. (lettering and design). No. 533065. Class 8. Electrically fitted switchboards, illuminated signs, ignition coils and their parts, searchlight apparatus, voltmeters, ammeters, loud speakers, radio-telephonic and telegraphic receiving and transmitting sets and parts, electric regulators, contact breakers and electric lighters. C.A.V. No. 533066. All goods in Class 8.—C.A.V.-Bosch, Ltd., Warple Way, Acton Vale, W.3.

Universal (lettering and design). No. 533777. Class 8. Loudspeaker units, coils, coil stands, valve holders, high frequency chokes, transformers, battery eliminators, accumulators, and fixed condensers, all being for use in radio telephony and telegraphy.—Universal Electric Supply Co., Ltd., 4, Brown Street, Manchester.

Pelp. No. 535536. Class 8. Electric storage batteries (not for medical purposes).—Portable Electric Power Co., Ltd., Quadrant House, 56-58, Pall Mall, S.W.1.

Winlite. No. 536382. Class 8. Lamp batteries.—Windsor Works, Ltd., 68, Venn Street, Clapham Common, S.W.4.

Structakit. No. 536630. All goods in Class 8.—Peto Scott Co., Ltd., 77, City Road, E.C.1.

Wizard. No. 534935. Class 13. Electric flat irons.—W. R. M. Mitchell, trading as the Mitchell Electric Co., University Buildings, 5, Edmund Street, Birmingham.

English Electric Co.'s Activities

Some of the more important contracts carried out during the past twelve months at the four works of the English Electric Co., Ltd., have been described in the ELECTRICAL REVIEW (May 13th, July 15th, and November 4th). Other notable orders include one from the Skinningrove Iron Works for the change-over from 25 to 50 cycles of the 12,000- and 19,000-h.p. reversing mills. A repeat order for a 7,500-kW frequency changer for the same system is also in hand. Several d.c. 12-kV generators have been made for the B.B.C. Turbo-alternators delivered or set to work include three of 30,000 kW for Thornhill (Y.E.P.), one of 25,000 kW for Blackburn Meadows (Sheffield), two of 10,000 kW for Yallourn (Victoria), one of 15,000 kW for the Polish Government, and one of 10,000 kW for Hayle (Cornwall E.P. Co.). Three 15,500- and two 16,800-h.p. water turbine alternators are under construction for the Galloway water power scheme.

There has been a steady demand for switchgear and transformers and connecting supply networks to the grid, and orders have also been received for India, Athens, Johannesburg, Capetown, and the V.F.P. Co. On-load top changing gear is now being incorporated in transformers for export. The C.E.B. ordered the first induction regulators used on the grid; these have oil-immersed operating gear and Buchholtz protection. There has been a steady production of equipment for trolley-buses and tramways, and arrangements have been made to produce Diesel-electric locomotives.

The demand for the new fires has called for a considerable extension of the department. Five sizes of electric cookers will shortly be available, and the range of small motors has been greatly extended.

Switchgear of one million kVA has been supplied for connecting up the Southern Railway's new electrification scheme to the 132-kV grid and also a 10,000-kVA 6.6/33-kV transformer.

The new induction roll heater (ELECTRICAL REVIEW, August 12th) has been in steady demand for home and foreign steel works. Important recent developments include Deion grid circuit breakers, grid-controlled rectifiers, h.v., d.c. generators for electrostatic precipitation, the Branchu current limiter, and the 33-kV "falling-frame" switch-fuse for rural distribution.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington.—Extensions to Ewbank Works; Entwistle and Kenyon. Extensions to Pioneer Works; Whittaker Bros.

Acton.—Factories for various firms; F. E. Simpkins, architect, Park Royal Road, N.W.10. Additions to factory for Raymakers Syndicate, Ltd., Park Royal Road; F. H. Toms, architect, Whitchurch, Hants.

Aldershot.—Houses (100); borough surveyor.

Alfreton.—Houses (26); G. Brentnall, builder, Riddings.

Barking.—Schools (£38,340); T. Bates & Sons, builders, Warwick Street, Coventry.

Batley (YORKS).—Business stores, Batley Carr, for Dewsbury Pioneers' Industrial Society, Ltd.; secretary.

Bedfordshire.—School, Haynes; H. E. Baines, director of education, Bedford.

Bexley.—Houses (48); New Ideal Homesteads, Ltd.

Birkdale.—Church of Our Lady of Lourdes, Hillside (electric lighting installations); F. X. Velarde, architect, 3, Abercromby Square, Liverpool.

Birmingham.—Hotel, Suffolk Street and Severn Street, for A. E. Mayer (electric lighting); J. Cotton, architect, 35, Waterloo Street.

Blackpool.—Houses (74), near Highfield Road, Marton; F. Wood, borough engineer.

Bournemouth.—Estate development, Kingswell Road; R. A. Watton. Junior school, Kinson, and houses (102); borough engineer.

Bradford.—Houses (299), Dick Lane, for Sutton Trust; Wm. Thompson & Sons, contractors, Sheepscar Street North.

Brentwood (ESSEX).—Hospital, Middleton Hall Estate (£29,677); C. S. Foster & Sons, builders, Loughton.

Bromley (KENT).—Cinema, High Street; F. C. Mitchell.

Burnley.—Extensions, Town Hall; borough surveyor.

Caerphilly.—General Post Office, The Twyn; H.M. Office of Works, King Charles Street, S.W.1.

Cheltenham.—Houses (34), St. Mark's Estate, and rehousing scheme, Alstone Lawn; borough surveyor.

Chesterfield.—Houses (39), Bacons Lane (£11,750); W. Memory, Sheffield.

Chester-le-Street (DURHAM).—Houses (150), Birtley; Mr. Wilson, R.D.C. surveyor.

Cleator Moor (CUMBERLAND).—Methodist Church for the trustees; T. T. Moss, secretary.

Coventry.—Church, Earlsdon; E. Harris & Son, builders, Cope Street.

Croydon.—Houses (26), shops and garages, Sussex Road; J. R. R. Oddy, 14, Senhouse Road, Cheam. Six shops, Mead Place, and 36 houses, Selsdon Road; P. Richardson, 139, Wickham Road.

Dalkeith.—Garage and workshops for Scottish Motor Traction Co.; manager, Edinburgh.

Darlington.—Extensions, Girls' High School; E. Minors, borough surveyor.

Dorchester.—Houses (32), Victoria Park site; borough surveyor.

Ealing.—Houses (60), Curry Road; Bindon Building Co., Bridle Road, Eastcote. Houses (56), Whitton Avenue; Wood & Waller, Valley Farm Estate, Kingsbury. Development, Abbey Drive Estate; G. L. Russell, architect, 1, Broad Street Buildings, Liverpool Street, E.C.2. Shops, Broadway; T. B. Daniel.

Earsdon (NORTHUMBERLAND).—Houses (20), Holywell; J. Carruther & Sons, builders, Percy's Square, Tynemouth.

Easingwold.—Houses (22); C. W. C. Needham, architect, 29, High Ousegate, York.

Essex.—School (1,250 places), Tilbury; J. Sargent, director of education, Chelmsford.

Eston (MIDDLESBROUGH).—Houses (106) and bungalows (46), Grangetown Garden Village Estate; U.D.C. surveyor.

Feltham.—Houses (68), Fagg's Road; J. P. Blake, architect, Bank House, High Street, Hounslow.

Fenton (STAFFS).—Workshops for the blind, Wesley Street (£35,155); Ball & Robinson, Stoke-on-Trent.

Grantham.—Business stores for Montague Burton, Ltd., Leeds; E. & T. Bower, Ltd., builders, Halifax.

Great Yarmouth.—Development of Cliff Park Estate; Ferrier & Ferrier, North Quay. Factory extensions, Pier Place, Gorleston; Johnson & Sons, Ltd.

Greenford (MIDDLESEX).—Alterations, Playhouse Cinema; licensee.

Hanley (STAFFS).—Conversion of Palace Skating Rink to cinema; Palace Amusements, Ltd.

Henstead (NORFOLK).—Houses (107); R.D.C. surveyor.

Hillingdon.—Church of All Saints; Cornish & Gaymer, contractors, North Walsham.

Hounslow (MIDDLESEX).—Alterations, Empire Cinema; licensee.

Hull.—Coach station and municipal garage, Dock site (£111,243); city engineer. Re-erection of laundry (£12,000), Pulman Street, for the Cromwell Laundry Co.

Irish Free State.—(CASTLEBAR, CO. MAYO).—County hospital for the County Board of Health; R. M. Butler, architect, 82, Merrion Square South, Dublin. (KILCULLEN, CO. KILDARE).—Town Hall; P. J. Foley, architect, 102, Grafton Street, Dublin.

Kent.—Elementary school (700 places), Blackfen, for the County E.C.

Kilmarnock.—Houses (90), Stonyhill site; burgh surveyor.

Lanarkshire.—Houses (56), Douglas, Plains, and Strathaven (electrical work); P. C. Smith, architect, 13, Clydesdale Street, Hamilton. R.C. school, Carfin; J. Stewart, architect, 20, Albert Street, Motherwell.

Lanchester.—Houses (52), various sites; E. Simpkin, surveyor, Council Offices.

Leeds.—Houses (265), Halton Hill, for Sutton Trust; Wm. Thompson & Sons, contractors, Sheepscar Street North. Church extension scheme, Osmondthorpe; Rev. Canon W. T. Elliott. Schools, New York Road, for the Catholic Authorities; Empsall, Clarkson & Clarke, architects, Piece Hall Yard, Bradford.

Liverpool.—Elementary school (400 places), Sherwoods Lane and Longmoor Lane; A. D. Jenkins, land steward and surveyor, Municipal Offices, Dale Street.

London.—(BROCKLEY).—Dwellings (£14,859) for L.C.C.; Gee, Walker & Slater, Ltd., builders, 58, Pall Mall, S.W. (ISLINGTON).—Rehousing, Hope Street area (£74,000); L.C.C. architect. (POPLAR).—Development, West Ferry Road area (£70,000); L.C.C. architect.

Long Ashton (BRISTOL).—Houses (20), Yatton; R.D.C. surveyor.

Lowestoft.—Greyhound track; P. Huckle, 20, Denmark Road. Extensions, coach building factory, Laundry Lane; Eastern Counties Bus Co., Ltd.

Macclesfield.—Houses (28), Poynton; J. H. Walters, architect.

Maidstone.—Cinema, Old Brewery, Stone Street; Bernstein Theatres, Ltd., London.

Manchester.—Hospital, Cheetham Hill Road; J. C. Daniels, secretary, Manchester Northern Hospital for Women and Children.

Melton Mowbray.—Bazaar stores, Sherrard Street; F. W. Woolworth & Co., Ltd., London.

Mold.—Central school, Broncoed Park (electric lighting installations); R. G. Whitley, county architect.

Newport (I.o.W.).—Houses (30); Mr. Slater, borough surveyor.

North Shields.—Houses (24) near the Bull Ring for the Square Building Trust. Houses (22), North Chirton Estate; Haswell and Sons, architects, 77, Tyne Street.

Nuneaton.—Alterations and additions to Hartshill sewage disposal works; R. C. Moon, borough engineer.

Oakhill (STAFFS).—Estate development, London Road, for W. Ball & Sons; Beckett & Bloore, architects.

Orsett (ESSEX).—Houses (23); G. F. Andrassy, R.D.C. surveyor, Palmer's Avenue, Grays.

Pinner (MIDDLESEX).—New station (£12,000), for Metropolitan Railway.

Pocklington (YORK).—Houses (24), Percy Street; H. E. Thomas, Ltd., builders, York.

Pontefract.—Works extensions, Mill Dam, for Wilkinsons (Bradford), Ltd. Houses (100); F. Haslam, Ltd., builders.

Portmadoc.—New Church of the Holy Family; G. & J. P. Gregory, builders, 24, High Street, Caernarvon.

Ramsbottom.—Reconstruction of the Royal Cinema; manager.

Rawtenstall.—Alterations to Holme Bank Foundry; B. Barnes and Sons. Alterations, Osborne Mill, Burnley Road; Lambert, Haworth & Sons, Ltd.

Reading.—School, Basingstoke Road, for the Borough E.C.; C. Smith & Son, architects, 164, Friar Street.

Romford.—Houses (42), Rainham; R.D.C. surveyor.

Rotherham.—Enlargement to Tivoli Cinema, Masbro' Street; Woffenden & Barker.

Salford.—Catholic church, Pendleton (£16,000); Fearnley and Sons, builders.

Salisbury.—Church; Rev. Canon Casey, 85, Exeter Street.

Sandown (I.o.W.).—Concert pavilion (£26,000); J. Stanley Beard & Clare, architects, 101, Baker Street, London, W.

Sandwich.—Houses, Laburnum Avenue; Council's surveyor.

Scarborough.—Church, Burniston Road; vicar of Scalby.

Sedgley.—Development, Turls Hill Estate; Estate Co.

Sheffield.—Houses (200), Shiregreen; W. G. Davies, city architect, Town Hall.

Shipley.—Houses (64), Wrose Road; A. & F. Mellor.

Sittingbourne & Milton Regis.—Houses (120), Bobbing Road site; U.D.C. surveyor.

South Molton (DEVON).—Re-erection of parish church, Mariansleigh; Rev. W. V. Tatham, vicar.

Southport.—Development of Ainsdale Beach, with transformer chamber and compressor house; A. E. Jackson, borough engineer.

South Shields.—Extensions to Ingham Infirmary (£50,000); G. Bailey, Ltd., builders.

Stalybridge.—Modernisation of markets; borough engineer.

Stockton-on-Tees.—Houses (162); G. P. Stainsby, architect, 25, High Street.

Sunderland.—Alterations, Royal Hotel; D. Glen, builder, Back Queen's Road, Jarrow.

Surrey.—School, Hinchley Wood, Esher; W. W. Finny, secretary, Kingston-on-Thames.

Swansea.—Hotel, Ivey Place; H. K. Bassett.

Thornton Heath (SURREY).—St. Oswald's Church (£12,500); Rev. P. E. Wilson, vicar.

Tunstall.—Estate development, Clanway Lane, for W. & P. Adams; Wood & Goldstraw, architects.

Tynemouth.—Administration block, Moor Park Hospital (£12,000); J. L. Beckett, borough engineer, Town Hall.

Uttoxeter.—Extensions (£40,000), with engineers' shops, laboratories, &c. (electrical work), for Wilts United Dairy Co., Ltd.; Bovis, Ltd., contractors, 43, Upper Berkeley Street, London, W.

Wallsend-on-Tyne.—Houses (34), Westfield, for J. H. James, builder, Westfield.

Watford.—Houses (62); borough surveyor.

Wealdstone.—Additions, Northwick Park Hall, Hawthorne Avenue; Northwick Park Halls, Ltd.

West Hartlepool.—Houses (37), various sites, for F. Craven, builder, 42, Stockton Street.

West Riding.—School, Stainforth (£30,000), for C.C.

Whitehaven.—Extensions, King Street, for Beehive, Ltd.; J. S. Stout, architect, 36, Lowther Street.

Widnes.—Houses (108), Kingsway; borough engineer, Town Hall.